

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Monique Wills Examiner #: 75068 Date: 5/17/04
Art Unit: 1746 Phone Number 30 272 1309 Serial Number: 10/052226
Mail Box and Bldg/Room Location 6C21 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: _____

Inventors (please provide full names): _____

Earliest Priority Filing Date: 7/30/99 Jap

**For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.*

0329020150819

Please do a search on claims 1-5

STAFF USE ONLY

Searcher: J. S. S. S.

Searcher Phone #: _____

Searcher Location: _____

Date Searcher Picked Up: 5/21/04

Date Completed: 5/21/04

Searcher Prep & Review Time: 120

Clerical Prep Time: 120

Online Time: _____

Type of Search

NA Sequence (#) _____

AA Sequence (#) _____

Structure (#) ✓

Bibliographic ✓

Litigation _____

Fulltext _____

Patent Family _____

Other _____

Vendors and cost where applicable

STN _____

Dialog _____

Questel/Orbit _____

Dr. Link _____

Lexis/Nexis _____

Sequence Systems _____

WWW/Internet _____

Other (specify) _____



STIC Search Report

EIC 1700

STIC Database Tracking Number: 122386

To: Monique Wills
Location: REM 6C21
Art Unit : 1746
May 21, 2004
Case Serial Number: 10/052226

From: John Calve
Location: CP 3/4; 3D62
Phone: 308-4139

John.Calve@uspto.gov

Search Notes

Hi Monique,

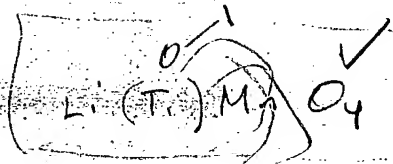
I searched for the compound in claim 1. I was a little confused about the last line in claim 1 "a sum of x_1, x_2, \dots, x_m " is 1, because the examples in the spec. have Ti and Ni as $.05 = .1$? I am sure I am reading it incorrectly. I searched for a range on the lithium of 1-2 because Li was in the group of 15 elements listed in third line from bottom of claim 1. I didn't specifically search for Fe, Ni..... because most of the answers where 4 elements only and I didn't get that many hits in HCA.

If you have any questions, please feel free to call me at your convenience.

John

703-308-4139.

7/10/00



09/013127

What is claimed is:

1. A lithium secondary battery, wherein lithium manganese oxide is used as a positive active material, said lithium manganese oxide having a cubic spinel

structure of which said lithium manganese oxide has a length ratio of a primary endothermal peak (P₁) appearing around

950°C and a secondary endothermal peak (P₂) appearing around 1100°C in differential thermal analysis, is 0.5 or less, said lithium manganese oxide having a formula

$\text{Li}(\text{M}_1(\text{x}_1)\text{M}_2(\text{x}_2)\text{M}_3(\text{x}_3)\dots\text{M}_m(\text{x}_m))_{1-x}\text{Mn}_{2-x}\text{O}_4$, wherein M₁ is Ti and M₂, M₃...M_m are metals selected from the group consisting of Li, Fe, Ni, Mg, Zn, Co, Cr, Sn, P, V, Sb, Nb, Ta, Mo and W, and wherein x is a substituted amount, and wherein a sum of X₁, X₂, X₃,...and X_m is 1.

= 14 elements

LiTi Mn, y, z

2. The lithium secondary battery according to claim 1, wherein a Li/Mn ratio in said lithium manganese oxide is over 0.5.

3. The lithium secondary battery according to claim 1, wherein said lithium manganese oxide is yielded by firing a mixture of salt(s) and/or oxide(s) of respective elements adjusted to a given proportion in an oxidation atmosphere, under a temperature in the range of 650 to 1000°C, and for a duration between 5 hours and 50 hours.

1050226.011702

=> file hca

FILE 'HCA' ENTERED AT 11:03:19 ON 21 MAY 2004

USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.

PLEASE SEE "HELP USAGETERMS" FOR DETAILS.

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FILE COVERS 1907 - 20 May 2004 VOL 140 ISS 22

FILE LAST UPDATED: 20 May 2004 (20040520/ED)

This file contains CAS Registry Numbers for easy and accurate substance identification.

=> d his

(FILE 'HOME' ENTERED AT 09:49:27 ON 21 MAY 2004)

FILE 'HCA' ENTERED AT 09:49:37 ON 21 MAY 2004

E US20020150819/PN

L1 1 S E3
SEL L1 RN

FILE 'REGISTRY' ENTERED AT 09:50:08 ON 21 MAY 2004

L2 3 S E1-E3

FILE 'HCA' ENTERED AT 09:52:18 ON 21 MAY 2004

FILE 'REGISTRY' ENTERED AT 09:53:19 ON 21 MAY 2004

L3 1 S L2 AND 0-1/TI

FILE 'HCA' ENTERED AT 09:53:33 ON 21 MAY 2004

L4 2 S L3
L5 93290 S TAKAHASHI ?/AU
L6 2 S L4 AND L5

FILE 'REGISTRY' ENTERED AT 10:38:42 ON 21 MAY 2004

L7 95092 S 1-2/LI
L8 231404 S 0-1/TI
L9 419066 S 1-2/MN
L10 3332915 S 3.8-4.2/O
L11 5080 S L7 AND L8
L12 767 S L11 AND L9
L13 313 S L12 AND L10

FILE 'LREGISTRY' ENTERED AT 10:41:35 ON 21 MAY 2004

FILE 'REGISTRY' ENTERED AT 10:44:26 ON 21 MAY 2004

E O2SI/MF
E SILICA/CN
L14 1 S E3
L15 0 S L13 AND 7631-86-9/CRN
L16 77 S L13 AND 0-2/SI
L17 236 S L13 NOT L16
L18 16 S L17 AND 0-2/P
L19 220 S L17 NOT L18

FILE 'HCA' ENTERED AT 10:48:50 ON 21 MAY 2004

L20 124 S L19
L21 37819 S SPINEL?
L22 711980 S ELECTRODE? OR ANODE? OR CATHODE?
L23 79 S L20 AND L22
L24 42 S L23 AND L21
L25 3008010 S (TEMP# OR TEMPERATURE##)
L26 166541 S L25(3N)RANGE####
L27 0 S L24 AND L26
L28 0 S L23 AND L26
L29 9 S L24 AND L25
L30 26 S L24 AND 1907-1999/PY,PRY
L31 4 S L30 AND L29

FILE 'REGISTRY' ENTERED AT 10:52:52 ON 21 MAY 2004

L32 419066 S 1-2/MN
L33 220 S L19 AND L32

FILE 'LREGISTRY' ENTERED AT 10:54:30 ON 21 MAY 2004

FILE 'REGISTRY' ENTERED AT 10:57:17 ON 21 MAY 2004

L34 411147 S 0-1/MN
L35 220 S L33 AND L34
L36 19978 S 0-.9/MN
L37 96 S L33 AND L36
L38 17127 S 0-.7/MN
L39 90 S L35 AND L38
L40 130 S L35 NOT L39

FILE 'HCA' ENTERED AT 10:59:09 ON 21 MAY 2004

L41 94 S L40
L42 42 S L24 AND L41
L43 56 S L41 AND 1907-1999/PY,PRY
L44 46 S L43 AND L22
L45 26 S L44 AND L21
L46 4 S L45 AND L25

FILE 'LCA' ENTERED AT 11:00:45 ON 21 MAY 2004

L47 10981 S HEAT? OR CALEFACT? OR TORREFACT? OR PYROL? OR SINTER? OR CALC
L48 9292 S HEAT? OR PYROL? OR SINTER? OR CALCIN? OR MELT? OR FUSE# OR F

FILE 'HCA' ENTERED AT 11:01:34 ON 21 MAY 2004

L49 7 S L45 AND L48
L50 1303330 S SIZE? OR DIAMETER? OR RADIUS## OR RADII##
L51 3 S L45 AND L50
L52 11 S L46 OR L49 OR L51
L53 15 S L45 NOT L52

FILE 'HCA' ENTERED AT 11:03:19 ON 21 MAY 2004

=> d L52 1-11 cbib abs hitind hitstr

L52 ANSWER 1 OF 11 HCA COPYRIGHT 2004 ACS on STN

135:79439 Manufacture of **spinel** type lithium manganate and **cathode** active mass for secondary nonaqueous electrolyte batteries. Numata, Koichi; Kamata, Tsuneyoshi (Mitsui Mining and Smelting Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001180939 A2 20010703, 30 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-367557 19991224.

AB **Spinel** type Li manganate is prepared by mixing electrolytic MnO₂ and/or MnCO₃ containing ≥ 150 ppm Mg with a Li source and an amount of source compound of Mg, Al, Fe, Cu, Zn, Ca, Si, P, Ti, Cr, Na, K, V, and/or B sufficient to replace 0.05-12.5 mol.% of Mn and **sintering** the mixture The Li manganate is used as **cathode** active mass in secondary Li batteries.

IC ICM C01G045-12

ICS H01M004-02; H01M004-58; H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST secondary battery **cathode** substituted lithium manganate manuf

IT Battery **cathodes**

(comps. and manufacture of magnesium containing substituted **spinel** type lithium manganate for secondary lithium battery **cathodes**)

IT 12057-17-9P, Lithium manganese oxide (LiMn₂O₄) 130260-87-6P, Chromium lithium manganese oxide (Cr_{0.1}LiMn_{1.9}O₄) 130732-38-6P, Iron lithium manganese oxide (Fe_{0.2}LiMn_{1.8}O₄) 130811-80-2P, Lithium manganese nickel oxide (LiMn_{1.8}Ni_{0.2}O₄) 136479-29-3P, Calcium lithium manganese oxide (Ca_{0.1}LiMn_{1.9}O₄) 136479-30-6P, Lithium manganese zinc oxide (LiMn_{1.9}Zn_{0.1}O₄) 136479-37-3P, Lithium magnesium manganese oxide (LiMg_{0.2}Mn_{1.8}O₄) 136479-43-1P, Lithium magnesium manganese oxide (LiMg_{0.1}Mn_{1.9}O₄) 143599-23-9P, Lithium manganese zinc oxide (LiMn_{1.8}Zn_{0.2}O₄) 145423-77-4P, Lithium manganese borate oxide (LiMn_{1.9}(BO₃)_{0.1}O_{3.7}) 145896-59-9P, Aluminum lithium manganese oxide (Al_{0.1}LiMn_{1.9}O₄) 146956-26-5P, Cobalt lithium manganese oxide (Co_{0.1}LiMn_{1.9}O₄) 147787-62-0P, Lithium manganese nickel oxide (LiMn_{1.9}Ni_{0.1}O₄) 147812-19-9P, Iron lithium manganese oxide (Fe_{0.1}LiMn_{1.9}O₄) 152013-71-3P, Lithium manganese titanium oxide (LiMn_{1.8}Ti_{0.2}O₄) 171827-58-0P, Aluminum lithium manganese oxide (Al_{0.25}LiMn_{1.75}O₄) 171827-60-4P, Cobalt lithium manganese oxide (Co_{0.25}LiMn_{1.75}O₄) 177988-73-7P, Lithium manganese titanium oxide (LiMn_{1.9}Ti_{0.1}O₄) 182866-80-4P, Lithium manganese vanadium oxide (LiMn_{1.9}V_{0.1}O₄) 188592-69-0P, Cobalt lithium manganese oxide (Co_{0.01}LiMn_{1.99}O₄) 191025-26-0P, Lithium manganese oxide silicate (LiMn_{1.8}O_{3.2}(SiO₄)_{0.2}) 191025-29-3P, Calcium lithium manganese oxide (Ca_{0.2}LiMn_{1.8}O₄) 191025-31-7P, Copper lithium manganese oxide (Cu_{0.2}LiMn_{1.8}O₄) 192754-58-8P, Lithium manganese nickel oxide (LiMn_{1.99}Ni_{0.01}O₄) 192754-63-5P, Chromium lithium manganese oxide (Cr_{0.01}LiMn_{1.99}O₄) 198195-81-2P, Lithium manganese borate oxide (LiMn_{1.98}(BO₃)_{0.02}O_{3.94}) 198830-10-3P, Chromium lithium manganese oxide (Cr_{0.25}LiMn_{1.75}O₄) 201857-54-7P, Copper lithium manganese oxide (Cu_{0.1}LiMn_{1.9}O₄) 209470-15-5P, Aluminum lithium manganese oxide (Al_{0.01}LiMn_{1.99}O₄) 209470-17-7P, Iron lithium manganese oxide (Fe_{0.01}LiMn_{1.99}O₄) 220480-69-3P, Lithium manganese oxide silicate (LiMn_{1.9}O_{3.6}(SiO₄)_{0.1}) 347384-54-7P, Lithium magnesium manganese oxide (LiMg_{0.01}Mn_{1.99}O₄) 347384-56-9P, Lithium manganese oxide phosphate (LiMn_{1.9}O_{3.6}(PO₄)_{0.1}) 347384-57-0P, Lithium manganese oxide phosphate (LiMn_{1.8}O_{3.2}(PO₄)_{0.2}) 347384-58-1P, Lithium manganese sodium oxide (LiMn_{1.98}Na_{0.02}O₄) 347384-59-2P, Lithium manganese sodium oxide

(LiMn1.9Na0.1O4) 347384-60-5P, Lithium manganese potassium oxide
 (LiMn1.98K0.02O4) 347384-61-6P, Lithium manganese potassium oxide
 (LiMn1.9K0.1O4) 347384-62-7P, Lithium manganese vanadium oxide
 (LiMn1.99V0.01O4) 347384-63-8P, Lithium manganese vanadium oxide
 (LiMn1.75V0.25O4)
 RL: DEV (Device component use); IMF (Industrial manufacture); PREP
 (Preparation); USES (Uses)
 (comps. and manufacture of magnesium containing substituted **spinel**
 type lithium manganate for secondary lithium battery **cathodes**
)

IT 7439-95-4, Magnesium, uses

RL: MOA (Modifier or additive use); USES (Uses)

(magnesium containing manganese sources in manufacture of lithium
 manganate for

secondary lithium battery **cathodes**)

IT 598-62-9, Manganese carbonate 1313-13-9, Manganese dioxide, processes

RL: PEP (Physical, engineering or chemical process); PROC (Process)

(magnesium containing manganese sources in manufacture of lithium
 manganate for

secondary lithium battery **cathodes**)

IT 152013-71-3P, Lithium manganese titanium oxide (LiMn1.8Ti0.2O4)

177988-73-7P, Lithium manganese titanium oxide (LiMn1.9Ti0.1O4)

RL: DEV (Device component use); IMF (Industrial manufacture); PREP

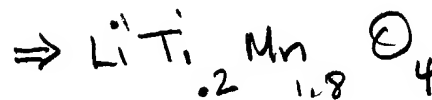
(Preparation); USES (Uses)

(comps. and manufacture of magnesium containing substituted **spinel**
 type lithium manganate for secondary lithium battery **cathodes**
)

RN 152013-71-3 HCA

CN Lithium manganese titanium oxide (LiMn1.8Ti0.2O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.2	7440-32-6
Mn	1.8	7439-96-5
Li	1	7439-93-2



RN 177988-73-7 HCA

CN Lithium manganese titanium oxide (LiMn1.9Ti0.1O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.1	7440-32-6
Mn	1.9	7439-96-5
Li	1	7439-93-2

L52 ANSWER 2 OF 11 HCA COPYRIGHT 2004 ACS on STN

134:283305 Secondary lithium batteries and manufacture of wound

electrode stacks. Kito, Masanobu; Nemoto, Hiroshi (NGK

Insulators, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001110456 A2

20010420, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-292071
 19991014.

AB The batteries have a wound **electrode** stack, where the
cathode active mass is a cubic crystalline **spinel** type

LiMn₂O₄, and the **cathode** active mass layer has d 2-3.5 g/cm³.
 The batteries are prepared by applying the **cathode** active mass on a collector, and roll pressing at **elevated temperature** to the required active mass layer d.

IC ICM H01M010-40
 ICS H01M004-02; H01M004-04; H01M004-58

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST secondary battery **cathode** manuf lithium manganese oxide density

IT Battery **cathodes**
 (manufacture of cubic crystalline **spinel** type lithium manganese oxide **cathodes** with controlled d. for wound **electrode** stack in secondary lithium batteries)

IT 12057-17-9, Lithium manganese oxide (LiMn₂O₄) 155472-68-7, Lithium manganese oxide (Li_{1.1}Mn_{1.9}O₄) 176979-23-0, Lithium manganese oxide (Li_{1.15}Mn_{1.85}O₄) **333337-19-2**, Lithium manganese nickel titanium oxide (LiMn_{1.8}(Ni,Ti)O₂) **333337-21-6**
 RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
 (manufacture of cubic crystalline **spinel** type lithium manganese oxide **cathodes** with controlled d. for wound **electrode** stack in secondary lithium batteries)

IT **333337-19-2**, Lithium manganese nickel titanium oxide (LiMn_{1.8}(Ni,Ti)O₂) **333337-21-6**
 RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PROC (Process); USES (Uses)
 (manufacture of cubic crystalline **spinel** type lithium manganese oxide **cathodes** with controlled d. for wound **electrode** stack in secondary lithium batteries)

RN **333337-19-2** HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.8}(Ni,Ti)O₂) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0 - 0.2	7440-32-6
Ni	0 - 0.2	7440-02-0
Mn	1.8	7439-96-5
Li	1	7439-93-2

RN **333337-21-6** HCA

CN Lithium magnesium manganese titanium oxide (Li(Mg,Ti)O₂Mn_{1.8}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0 - 0.2	7440-32-6
Mn	1.8	7439-96-5
Mg	0 - 0.2	7439-95-4
Li	1	7439-93-2

L52 ANSWER 3 OF 11 HCA COPYRIGHT 2004 ACS on STN
 134:225061 **Cathode** active material for a nonaqueous electrolyte battery. Kuyama, Junji; Nagamine, Masayuki (Sony Corporation, Japan).

- Eur. Pat. Appl. EP 1083615 A2 20010314, 9 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 2000-119279 20000906. PRIORITY: JP 1999-254589 19990908.
- AB The present invention enables to obtain both of a cycle characteristic and a high load characteristic. The invention discloses a pos.
electrode active material containing lithium composite manganese oxide having a **spinel** structure for a nonaq. electrolyte cell and a nonaq. electrolyte cell using this material. The lithium composite manganese oxide having **spinel** structure has its primary particle **diameter** not less than 0.05 μm and not greater than 10 μm , forming an aggregate, and a sp. surface measured by the BET method in a range not less than 0.2 m^2/g and not greater than 2 m^2/g .
- IC ICM H01M004-50
ICS H01M004-48
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
- ST battery **cathode** lithium composite manganese oxide
- IT Battery **cathodes**
Sintering
(**cathode** active material for nonaq. electrolyte battery)
- IT Coke
RL: DEV (Device component use); USES (Uses)
(**cathode** active material for nonaq. electrolyte battery)
- IT Carbon fibers, uses
Carbonaceous materials (technological products)
Polyacenes
Polymers, uses
RL: DEV (Device component use); MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(**cathode** active material for nonaq. electrolyte battery)
- IT Fluoropolymers, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(**cathode** active material for nonaq. electrolyte battery)
- IT Secondary batteries
(lithium; **cathode** active material for nonaq. electrolyte battery)
- IT Lithium alloy, base
RL: DEV (Device component use); MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(**cathode** active material for nonaq. electrolyte battery)
- IT 75-05-8, Acetonitrile, uses 96-47-9, 2-Methyl tetrahydrofuran 96-48-0, γ -Butyrolactone 96-49-1, Ethylene carbonate 105-58-8, Diethyl carbonate 108-32-7, Propylene carbonate 109-99-9, Thf, uses 110-71-4, 1,2-Dimethoxyethane 126-33-0, Sulfolane 623-96-1, Dipropyl carbonate 646-06-0, 1,3-Dioxolane 2550-62-1, Methanesulfonic acid, lithium salt 7447-41-8, Lithium chloride, uses 7550-35-8, Lithium bromide 7791-03-9, Lithium perchlorate 14283-07-9, Lithium tetrafluoroborate 14485-20-2, Lithium tetraphenylborate 21324-40-3, Lithium hexafluorophosphate 29935-35-1, Lithium hexafluoroarsenate 33454-82-9, Lithium triflate 130811-80-2, Lithium manganese nickel oxide ($\text{LiMn}_{1.8}\text{Ni}_{0.2}\text{O}_4$) 329689-73-8, Lithium manganese titanium oxide ($\text{Li}_{0.9-1.4}\text{Mn}_{1.7-2}\text{Ti}_{0-0.3}\text{O}_4$) 329689-74-9, Lithium manganese vanadium oxide ($\text{Li}_{0.9-1.4}\text{Mn}_{1.7-2}\text{V}_{0-0.3}\text{O}_4$) 329689-76-1, Chromium lithium manganese oxide ($\text{Cr}_{0-0.3}\text{Li}_{0.9-1.4}\text{Mn}_{1.7-2}\text{O}_4$) 329689-77-2, Iron lithium manganese oxide ($\text{Fe}_{0-0.3}\text{Li}_{0.9-1.4}\text{Mn}_{1.7-2}\text{O}_4$) 329689-78-3, Cobalt lithium manganese oxide ($\text{Co}_{0-0.3}\text{Li}_{0.9-1.4}\text{Mn}_{1.7-2}\text{O}_4$) 329689-79-4, Aluminum lithium manganese oxide ($\text{Al}_{0-0.3}\text{Li}_{0.9-1.4}\text{Mn}_{1.7-2}\text{O}_4$) 329689-80-7, Lithium manganese nickel oxide ($\text{Li}_{0.9-1.4}\text{Mn}_{1.7-2}\text{Ni}_{0-0.3}\text{O}_4$) 329689-81-8, Lithium

manganese oxide (Li1.01Mn2O4) 329689-86-3, Cobalt lithium manganese oxide (Co0.02Li1.02Mn1.98O4) 329689-87-4, Lithium manganese vanadium oxide (Li0.96Mn1.9V0.1O4) 329689-88-5, Iron lithium manganese oxide (Fe0.15LiMn1.85O4) 329689-89-6, Chromium lithium manganese oxide (Cr0.25Li1.1Mn1.75O4)

RL: DEV (Device component use); USES (Uses)

(**cathode** active material for nonaq. electrolyte battery)

IT 7439-93-2, Lithium, uses 30604-81-0, Polypyrrole

RL: DEV (Device component use); MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(**cathode** active material for nonaq. electrolyte battery)

IT 7429-90-5, Aluminum, uses 24937-79-9, PvdF

RL: TEM (Technical or engineered material use); USES (Uses)

(**cathode** active material for nonaq. electrolyte battery)

IT 7440-44-0, Carbon, uses

RL: DEV (Device component use); MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(pyrocarbon; **cathode** active material for nonaq. electrolyte battery)

IT **329689-73-8**, Lithium manganese titanium oxide (Li0.9-1.4Mn1.7-2TiO-0.3O4)

RL: DEV (Device component use); USES (Uses)

(**cathode** active material for nonaq. electrolyte battery)

RN 329689-73-8 HCA

CN Lithium manganese titanium oxide (Li0.9-1.4Mn1.7-2TiO-0.3O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0 - 0.3	7440-32-6
Mn	1.7 - 2	7439-96-5
Li	0.9 - 1.4	7439-93-2

L52 ANSWER 4 OF 11 HCA COPYRIGHT 2004 ACS on STN

132:13904 Refractory metal-doped lithium manganate **spinel** composition for battery **cathode**. Brese, Nathaniel Eric; Gallagher, Michael Kenrick; Huang, Jian (Rohm and Haas Company, USA). Eur. Pat. Appl. EP 964463 A2 19991215, 13 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 1999-302698 19990407. PRIORITY: US 1998-PV89252 19980612; US 1998-181221 19981027.

AB The title composition is a compound of the formula $\text{Li}_q\text{M}_x\text{Mn}_y\text{O}_z$, where M is a refractory metal selected from the group consisting of Ti, Zr, Hf, V, Nb, Ta, Mo, and/or W; $q = 0-1.3$, $x = 0.0001-0.2$, $y = 1.8-2.0$, and $z = 3.8-4.2$. The compound is substantially phase pure, and prepared by spray **pyrolysis**. The secondary batteries according to the present invention have considerably reduced discharge capacity fade rates as compared to cells comprising **spinels** which are not phase pure.

IC H01M004-48; H01M004-50; H01M010-40; C01G045-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST battery **cathode** refractory metal doped lithium manganate

IT Secondary batteries

(lithium; refractory metal-doped lithium manganate **spinel** composition for battery **cathode**)

IT Battery **cathodes**
(refractory metal-doped lithium manganate **spinel** composition for battery **cathode**)

IT Refractory metals
RL: MOA (Modifier or additive use); USES (Uses)
(refractory metal-doped lithium manganate **spinel** composition for battery **cathode**)

IT 130242-31-8D, Lithium manganese oxide $\text{Li}_{1.05}\text{Mn}_2\text{O}_4$, oxygen-excess
147787-62-0D, Lithium manganese nickel oxide $\text{LiMn}_{1.9}\text{Ni}_{0.1}\text{O}_4$, oxygen-excess
182866-80-4D, Lithium manganese vanadium oxide $\text{LiMn}_{1.9}\text{V}_{0.1}\text{O}_4$, oxygen-excess
198195-78-7D, Gallium Lithium manganese oxide $\text{Ga}_{0.02}\text{LiMn}_{1.98}\text{O}_4$, oxygen-excess
209470-15-5D, Aluminum Lithium manganese oxide $\text{Al}_{0.01}\text{LiMn}_{1.99}\text{O}_4$, oxygen-excess
216002-31-2D, Lithium manganese tungsten oxide $\text{LiMn}_{1.9}\text{W}_{0.1}\text{O}_4$, oxygen-excess
251540-04-2D, Lithium manganese zirconium oxide ($\text{LiMn}_{1.98}\text{Zr}_{0.02}\text{O}_4$), oxygen-excess
251540-05-3D, Lithium manganese zirconium oxide ($\text{LiMn}_{1.95}\text{Zr}_{0.05}\text{O}_4$), oxygen-excess
251540-06-4D, Lithium manganese titanium oxide ($\text{Li}_{1.1}\text{Mn}_{1.99}\text{Ti}_{0.01}\text{O}_4$), oxygen-excess
251540-07-5D, Lithium manganese zinc oxide ($\text{Li}_{1.05}\text{Mn}_{1.94}\text{Zn}_{0.06}\text{O}_4$), oxygen-excess
251540-08-6D, Lithium manganese molybdenum oxide ($\text{Li}_{1.1}\text{Mn}_{1.9}\text{Mo}_{0.1}\text{O}_4$), oxygen-excess
251540-09-7D, Hafnium lithium manganese oxide ($\text{Hf}_{0.01}\text{LiMn}_{1.99}\text{O}_4$), oxygen-excess
251540-10-0D, Lithium manganese zirconium oxide ($\text{Li}_{0.98}\text{Mn}_{1.94}\text{Zr}_{0.06}\text{O}_4$), oxygen-excess
251540-11-1D, Lithium manganese niobium oxide ($\text{LiMn}_{1.99}\text{Nb}_{0.01}\text{O}_4$), oxygen-excess
251540-12-2D, Chromium lithium manganese oxide ($\text{Cr}_{0.01}\text{Li}_{1.1}\text{Mn}_{1.99}\text{O}_4$), oxygen-excess
RL: DEV (Device component use); USES (Uses)
(refractory metal-doped lithium manganate **spinel** composition for battery **cathode**)

IT **251540-06-4D**, Lithium manganese titanium oxide ($\text{Li}_{1.1}\text{Mn}_{1.99}\text{Ti}_{0.01}\text{O}_4$), oxygen-excess
RL: DEV (Device component use); USES (Uses)
(refractory metal-doped lithium manganate **spinel** composition for battery **cathode**)

RN 251540-06-4 HCA

CN Lithium manganese titanium oxide ($\text{Li}_{1.1}\text{Mn}_{1.99}\text{Ti}_{0.01}\text{O}_4$) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.01	7440-32-6
Mn	1.99	7439-96-5
Li	1.1	7439-93-2

L52 ANSWER 5 OF 11 HCA COPYRIGHT 2004 ACS on STN

130:239850 Use of Li-M-Mn-O [M = Co, Cr, Ti] **spinel**s prepared by a sol-gel method as **cathodes** in high-voltage lithium batteries. Hernan, Lourdes; Morales, Julian; Sanchez, Luis; Santos, Jesus (Laboratorio de Quimica Inorganica. Facultad de Ciencias, Universidad de Cordoba, Cordoba, E-14004, Spain). Solid State Ionics, 118(3,4), 179-185 (English) 1999. CODEN: SSIOD3. ISSN: 0167-2738. Publisher: Elsevier Science B.V..

AB ~~Doped spinels of formula $\text{LiM}_{0.2}\text{Mn}_{1.8}\text{O}_4$~~ (M = Cr, Co) and $\text{LiTi}_{0.19}\text{Mn}_{1.76}\text{O}_4$ were prepared by using a sol-gel method involving $\text{Mn}(\text{acac})_3$, $\text{Cr}(\text{acac})_3$, $[\text{Ti}(\text{acac})_3]_2[\text{TiCl}_6]$, and Li_2CO_3 as precursors and propionic acid as chelating agent. On firing at 600°, the gels

gave normal **spinel** phases of a high purity. The Co and Cr **spinels** consisted of very uniformly shaped microcrystals. The three doped **spinels** were tested as **cathodes** in 4 V lithium cells. The best performance was exhibited by the Co-doped **spinel**, followed by the Cr-doped **spinel**. By contrast, LiTi_{0.19}Mn_{1.76}O₄ exhibited significant capacity fading upon cycling. All lithium in the Co- and Cr-doped manganese **spinels** can be extracted by charging the cells above 5 V. Under these conditions, the cell based on the Cr-doped **spinel** provided the best electrochem. performance. Ionic **size** and ligand field stabilization energies were considered in explaining the structural stability of the **spinels**, which has a direct effect on **cathode** performance.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST lithium manganese oxide doped **spinel cathode** battery;
cobalt lithium manganese oxide **spinel cathode** battery;
chromium lithium manganese oxide **spinel cathode**
battery; titanium lithium manganese oxide **spinel cathode**
battery

IT Battery **cathodes**
(use of doped lithium manganese oxide **spinels** prepared by
sol-gel method as **cathodes** in high-voltage lithium batteries)

IT 130811-82-4, Cobalt lithium manganese oxide (Co_{0.2}LiMn_{1.8}O₄)
130917-43-0, Chromium lithium manganese oxide (Cr_{0.2}LiMn_{1.8}O₄)
221313-47-9, Lithium manganese titanium oxide (LiMn_{1.76}Ti_{0.19}O₄)
RL: DEV (Device component use); PEP (Physical, engineering or chemical
process); PROC (Process); USES (Uses)

(use of doped lithium manganese oxide **spinels** prepared by
sol-gel method as **cathodes** in high-voltage lithium batteries)

IT 221313-47-9, Lithium manganese titanium oxide (LiMn_{1.76}Ti_{0.19}O₄)
RL: DEV (Device component use); PEP (Physical, engineering or chemical
process); PROC (Process); USES (Uses)

(use of doped lithium manganese oxide **spinels** prepared by
sol-gel method as **cathodes** in high-voltage lithium batteries)

RN 221313-47-9 HCA
CN Lithium manganese titanium oxide (LiMn_{1.76}Ti_{0.19}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.19	7440-32-6
Mn	1.76	7439-96-5
Li	1	7439-93-2

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129:83687 Fundamental studies of the Cr³⁺ stabilized LiMn₂O₄ **spinel cathode** system. Robertson, A. D.; Lu, S. H.; Howard, W. F., Jr. (Covalent Associates, Inc., Woburn, MA, 01801, USA). Progress in Batteries & Battery Materials, 16, 20-29 (English) 1997. CODEN: PBBMEF. ISSN: 1099-4467. Publisher: ITE-JEC Press Inc..

AB The aim of this work was to develop LiMn₂O₄ **spinels** with dopant level modifiers (<5 mol%) retaining the favorable electrochem. characteristics of minimal capacity fade and maximum initial capacity. We have evaluated several electrochem. stable +3 ions as admetals, including Al, B, Fe, Ga and Ti. Only Cr³⁺ led to a LiMn₂O₄ **cathode** material with acceptable electrochem. performance. Cr-modified

spinels had excellent stability with cycle number at room **temperature** and 55°, even when <1 mol% Mn³⁺ was replaced by Cr³⁺. The optimum composition was LiCr_{0.012}Mn_{1.988} which minimized the initial capacity drop and had a stable discharge capacity of >110 mA-h/g even after 100 cycles.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 ST battery **cathode** chromium lithium manganese oxide
 IT Battery **cathodes**
 Surface area
 (fundamental studies of the Cr³⁺ stabilized LiMn₂O₄ **spinel** **cathode** system)

IT 12057-17-9, Lithium manganese oxide LiMn₂O₄ 181510-90-7, Lithium manganese borate oxide (LiMn_{1.99}(BO₃)_{0.01}O_{3.97}) 192754-63-5, Chromium lithium manganese oxide (Cr_{0.01}LiMn_{1.99}O₄) 204450-96-4, Chromium Lithium manganese oxide 209470-11-1, Chromium lithium manganese oxide (Cr_{0.07}LiMn_{1.93}O₄) 209470-13-3, Chromium lithium manganese oxide (Cr_{0.04}LiMn_{1.96}O₄) 209470-15-5, Aluminum lithium manganese oxide (Al_{0.01}LiMn_{1.99}O₄) 209470-16-6, Gallium lithium manganese oxide (Ga_{0.01}LiMn_{1.99}O₄) 209470-17-7, Iron lithium manganese oxide (Fe_{0.01}LiMn_{1.99}O₄) **209470-20-2**, Lithium manganese titanium oxide (LiMn_{1.99}Ti_{0.01}O₄) 209470-21-3, Lithium manganese yttrium oxide (LiMn_{1.99}Y_{0.01}O₄)
 RL: DEV (Device component use); USES (Uses)
 (fundamental studies of the Cr³⁺ stabilized LiMn₂O₄ **spinel** **cathode** system)

IT 16065-83-1, Chromium(3+), uses
 RL: MOA (Modifier or additive use); USES (Uses)
 (fundamental studies of the Cr³⁺ stabilized LiMn₂O₄ **spinel** **cathode** system)

IT **209470-20-2**, Lithium manganese titanium oxide (LiMn_{1.99}Ti_{0.01}O₄)
 RL: DEV (Device component use); USES (Uses)
 (fundamental studies of the Cr³⁺ stabilized LiMn₂O₄ **spinel** **cathode** system)

RN 209470-20-2 HCA
 CN Lithium manganese titanium oxide (LiMn_{1.99}Ti_{0.01}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.01	7440-32-6
Mn	1.99	7439-96-5
Li	1	7439-93-2

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127:348772 M³⁺-modified LiMn₂O₄ **spinel** intercalation

cathodes. I. Admetal effects on morphology and electrochemical performance. Robertson, A. D.; Lu, S. H.; Averill, W. F.; Howard, W. F., Jr. (Covalent Associates, Incorporated, Woburn, MA, 01801, USA). Journal of the Electrochemical Society, 144(10), 3500-3505 (English) ~~1997~~
 . CODEN: JESQAN. ISSN: 0013-4651. Publisher: Electrochemical Society.

AB Low levels of trivalent cations were utilized to stabilize LiMn₂O₄ **spinel** **cathode** materials against capacity decline during electrochem. cycling. Of the several single-phase products obtained, only those with Cr³⁺ and Ga³⁺ prevented capacity fade, and only LiCr_{0.02}Mn_{1.98}O₄ exhibited acceptable initial reversible capacity. The external particle morphol. was unchanged by the preparation or the admetal, and

the internal structures were all converted to cong tou (onion) configurations during product synthesis. Grain **size** played a surprising role in **cathode** performance: <25 μm material had at least 10% lower capacity than larger or as-prepared Cr-doped LiMn₂O₄.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST battery intercalation **cathode** lithium manganese oxide; trivalent cation modified **spinel** intercalation **cathode**

IT Intercalation
(electrochem.; performance of trivalent cation-modified LiMn₂O₄ **spinel** intercalation **cathodes**)

IT Secondary batteries
(lithium; performance of trivalent cation-modified LiMn₂O₄ **spinel** intercalation **cathodes**)

IT Battery **cathodes**
(performance of trivalent cation-modified LiMn₂O₄ **spinel** intercalation **cathodes**)

IT 12057-17-9, Lithium manganese oxide LiMn₂O₄ 192754-63-5, Chromium lithium manganese oxide (Cr_{0.01}LiMn_{1.99}O₄) 196406-78-7, Iron lithium manganese oxide Fe_{0.02}LiMn_{1.98}O₄ 198195-73-2, Aluminum lithium manganese oxide (Al_{0.02}LiMn_{1.98}O₄) 198195-74-3, Lithium manganese titanium oxide (LiMn_{1.98}Ti_{0.02}O₄) 198195-76-5, Chromium lithium manganese oxide (Cr_{0.02}LiMn_{1.98}O₄) 198195-78-7, Gallium lithium manganese oxide (Ga_{0.02}LiMn_{1.98}O₄) 198195-81-2, Lithium manganese borate oxide (LiMn_{1.98}(BO₃)_{0.02}O_{3.94})

RL: DEV (Device component use); USES (Uses)
(performance of trivalent cation-modified LiMn₂O₄ **spinel** intercalation **cathodes**)

IT 198195-74-3, Lithium manganese titanium oxide (LiMn_{1.98}Ti_{0.02}O₄)

RL: DEV (Device component use); USES (Uses)
(performance of trivalent cation-modified LiMn₂O₄ **spinel** intercalation **cathodes**)

RN 198195-74-3 HCA

CN Lithium manganese titanium oxide (LiMn_{1.98}Ti_{0.02}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.02	7440-32-6
Mn	1.98	7439-96-5
Li	1	7439-93-2

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127:37232 Nonaqueous electrolyte secondary batteries with alkali metal manganese oxide **cathodes** and oxide preparation. Okada, Shigeto; Arai, So; Masashiro, Takahisa; Otsuka, Hideaki; Sakurai, Yoji; Yamaki, Junichi (Nippon Telegraph and Telephone Corp., Japan). Jpn. Kokai Tokkyo Koho JP 09134723 A2 19970520 Heisei, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1995-311688 19951107.

AB The battery **cathodes** contain a mixed oxide $\text{A}'\text{Mn}_2\text{-xMxO}_4$ (A' = alkali metal; M = metal, $0.5 < x < 1.5$, $0 < y < 2$) as an active mass. The metal M is preferably selected from Fe, Ru, Os, Ti, Zr, Hf, Ni, Ta, Cr, Mo, W, Co, Rh, Ir, Ni, Sb, Si, Ge, Sn, and Pb. The oxide is prepared by mixing A compound, Mn compound, and M compound, **heating** to give random **spinel**- or reverse **spinel**-type structure, and quenching. The batteries have a small voltage difference between the 2 discharge regions and large total discharge capacity.

IC ICM H01M004-58
ICS H01M010-40
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST nonaq electrolyte battery **cathode** manganese **spinel**
IT Battery **cathodes**
(nonaq. electrolyte secondary batteries with alkali metal manganese oxide **cathodes** for discharge voltage and capacity)
IT 12016-89-6P, Cobalt lithium manganese oxide (CoLiMnO₄) 12022-45-6P, Iron lithium manganese oxide (FeLiMnO₄) **12031-62-8P**, Lithium manganese titanium oxide (LiMnTiO₄)
RL: DEV (Device component use); IMF (Industrial manufacture); PREP (Preparation); USES (Uses)
(active mass; nonaq. electrolyte secondary batteries with alkali metal manganese oxide **cathodes** for discharge voltage and capacity)
IT **12031-62-8P**, Lithium manganese titanium oxide (LiMnTiO₄)
RL: DEV (Device component use); IMF (Industrial manufacture); PREP (Preparation); USES (Uses)
(active mass; nonaq. electrolyte secondary batteries with alkali metal manganese oxide **cathodes** for discharge voltage and capacity)
RN 12031-62-8 HCA
CN Lithium manganese titanium oxide (LiMnTiO₄) (7CI, 9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	1	7440-32-6
Mn	1	7439-96-5
Li	1	7439-93-2

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125:37996 Production and use of ternary lithium-containing mixed oxides. Hemmer, Reinhard P.; Oesten, Ruediger; Wohlfahrt-Mehrens, Margret; Arnold, Gisela (Zentrum fuer Sonnenenergie- und Wasserstoff-Forschung Baden-Wuerttemberg, Germany). Ger. DE 4435117 C1 **19960515**, 8 pp. (German). CODEN: GWXXAW. APPLICATION: DE 1994-4435117 19940930.
AB **Spinel**-type ternary mixed oxides $\text{Li}_y\text{M}_x\text{Mn}_2\text{-xO}_4$ (M = metal cation from Group IIa, IIIa, IVa, IIb, IIb, IVb, Vb, VIb, VIIb, and VIII (especially

Fe, Ti, Al, Co, Ni); $x = 0-1$ (preferably $0-0.5$); $y = 0-1.2$) are prepared by (1) conversion of reaction components in the form of hydroxides and/or water-soluble metal salts dissolved in a basic aqueous medium at $0-25^\circ$ to form a homogeneous suspension, (2) removal of water and optionally solvents from the suspension of the hydroxide reaction product by spray drying at $120-200^\circ$ or freeze drying, and (3) **high-temperature** treatment by **heating** of the dried product at $1-20$ K/min to a range of $500-900^\circ$ (preferably $600-800^\circ$). The mixed oxide products are especially suitable for **cathodes** in Li secondary batteries.

IC ICM C01G045-02
ICS H01M010-26
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 78
ST mixed oxide **cathode** lithium battery
IT **Cathodes**
(manufacture of mixed oxides for lithium batteries)
IT 147787-62-0, Lithium manganese nickel oxide (LiMn_{1.9}Ni_{0.1}O₄)

147812-19-9, Iron lithium manganese oxide (Fe_{0.1}LiMn_{1.9}O₄)
177988-73-7, Lithium manganese titanium oxide (LiMn_{1.9}Ti_{0.1}O₄)
 RL: TEM (Technical or engineered material use); USES (Uses)
 (for **cathodes** in lithium batteries)
 IT 1310-65-2, Lithium hydroxide 10377-66-9, Manganese nitrate (Mn(NO₃)₂)
 10421-48-4, Iron nitrate (Fe(NO₃)₃) 13138-45-9, Nickel nitrate
 (Ni(NO₃)₂)
 RL: NUU (Other use, unclassified); USES (Uses)
 (in manufacture of **cathodes** for lithium batteries)
 IT **177988-73-7**, Lithium manganese titanium oxide (LiMn_{1.9}Ti_{0.1}O₄)
 RL: TEM (Technical or engineered material use); USES (Uses)
 (for **cathodes** in lithium batteries)
 RN 177988-73-7 HCA
 CN Lithium manganese titanium oxide (LiMn_{1.9}Ti_{0.1}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.1	7440-32-6
Mn	1.9	7439-96-5
Li	1	7439-93-2

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124:181095 **Cathode** material for secondary lithium batteries, and
 process and precursor material for its manufacture. Kelder, Erik M.
 (Danionics A/S, Den.). PCT Int. Appl. WO 9534919 A1 **19951221**,
 24 pp. DESIGNATED STATES: W: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ,
 DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT,
 LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,
 TJ, TM, TT; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, DE, DK, ES, FR, GA,
 GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English).
 CODEN: PIXXD2. APPLICATION: WO 1995-DK232 19950609. PRIORITY: DK
 1994-663 19940610.

AB The **cathode** material contains as its active ingredient
spinel Li-Mn oxide and also an inactive material of α -Mn₂O₃
 and/or Li₂MnO₃. This **cathode** material exhibits a higher Li
 chemical diffusion coefficient than pure **spinel** Li_{1+x}Mn₂O₄. The
cathode material can be prepared economically on industrial scale.
 The material is prepared by forming a **melt** from (AcO)₂Mn, LiOH and
 H₂O, keeping the **melt** at 70-110° for 10 min-4 h under
 stirring so as to form an essentially homogeneous material, drying and
calcining at 300-800°.

IC ICM H01M004-50

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 49

ST lithium manganese oxide battery **cathode**

IT **Cathodes**

(battery, **spinel** lithium-manganese oxide)

IT 174083-96-6P, Iron lithium manganese oxide (Fe_{0.1}Li_{1.1}Mn_{1.9}O₄)

174083-97-7P, Cobalt lithium manganese oxide (Co_{0.1}Li_{1.1}Mn_{1.9}O₄)

RL: PNU (Preparation, unclassified); TEM (Technical or engineered material
 use); PREP (Preparation); USES (Uses)

(**cathode** material for secondary lithium batteries and process
 and precursor material for its manufacture)

IT 174179-96-5, Cobalt lithium manganese oxide (Co_{0.1}Li_{0.1}Mn_{1.5}O₄)

174179-97-6, Lithium manganese nickel oxide (Li_{0.1}Mn_{1.5}Ni_{0.1}O₄)

174179-98-7, Lithium manganese titanium oxide (LiO-1.5Mn1-2TiO-104)
 174179-99-8, Lithium manganese vanadium oxide (LiO-1.5Mn1-2V0-104)
 174180-00-8, Iron lithium manganese oxide (FeO-1LiO-1.5Mn1-2O4)
 RL: TEM (Technical or engineered material use); USES (Uses)
 (cathode material for secondary lithium batteries and process and precursor material for its manufacture)
 IT 1317-34-6, Manganese oxide (Mn2O3) 12163-00-7, Lithium manganese oxide (Li2MnO3)
 RL: MOA (Modifier or additive use); USES (Uses)
 (lithium battery cathodes containing)
 IT 174179-98-7, Lithium manganese titanium oxide (LiO-1.5Mn1-2TiO-104)
 RL: TEM (Technical or engineered material use); USES (Uses)
 (cathode material for secondary lithium batteries and process and precursor material for its manufacture)
 RN 174179-98-7 HCA
 CN Lithium manganese titanium oxide (LiO-1.5Mn1-2TiO-104) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0 - 1	7440-32-6
Mn	1 - 2	7439-96-5
Li	0 - 1.5	7439-93-2

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116:70329 The **spinel** phase of lithium manganese oxide (LiMn2O4) as a **cathode** in secondary lithium cells. Tarascon, J. M.; Wang, E.; Shokoohi, F. K.; McKinnon, W. R.; Colson, S. (Bell Commun. Res., Red Bank, NJ, 07701-7040, USA). Journal of the Electrochemical Society, 138(10), 2859-64 (English) 1991. CODEN: JESQAN. ISSN: 0013-4651.

AB The electrochem. properties of LiMn2O4 and LiMyMn2-yO4 (M = Ti, Ge, Fe, Zn, or Ni) were studied for different conditions of sample preparation and different degrees of cation substitution (y). In the voltage range 3.5-4.5 V, cells of either **spinel** LiMn2O4 or λ -MnO2 (made by leaching the Li from the LiMn2O4) reversibly insert 0.4 Li per Mn at an average voltage of 4.1 V, leading to an energy d. of 480 Wh/kg of **cathode**. Cells cycled 50 times lost less than 10% of their initial capacity, suggesting that this material could be used instead of LiCoO2 or LiNiO2 as the **cathode** in the new generation of "rocking chair batteries". Replacing Mn with cations of valence 2 (Ni, Zn) or 3(Fe) reduces the amount of Mn3+ and correspondingly reduces the capacity of the cells at 4.1 V, but does not affect their cycling performance.

CC 72-2 (Electrochemistry)

Section cross-reference(s): 52, 75

ST lithium manganese oxide **cathode** secondary cell; battery
cathode lithium manganese oxide

IT **Cathodes**

(battery, lithium manganese oxide, **spinel** phase of)

IT 7439-93-2, Lithium, uses

RL: USES (Uses)

(batteries, secondary, **spinel** phase of lithium manganese oxide as **cathode** in)

IT 137972-90-8, Lithium manganese oxide (LiO.02Mn2O4) 137972-96-4,

- Lithium manganese titanium oxide (Li_{0.17}Mn_{1.5}Ti_{0.5}O₄) **137972-97-5**
, Lithium manganese titanium oxide (Li_{0.16}Mn_{1.7}Ti_{0.3}O₄)
137972-98-6, Lithium manganese titanium oxide (Li_{0.14}Mn_{1.8}Ti_{0.2}O₄)
137972-99-7, Lithium manganese titanium oxide (Li_{0.07}Mn_{1.9}Ti_{0.1}O₄)
138017-64-8, Lithium manganese titanium oxide
(Li_{0.06}Mn_{1.95}Ti_{0.05}O₄) 138017-65-9, Germanium lithium manganese oxide
(Ge_{0.1}Li_{0.02}Mn_{1.9}O₄) 138017-66-0, Germanium lithium manganese oxide
(Ge_{0.05}Li_{0.03}Mn_{1.95}O₄) **138017-67-1**, Lithium manganese titanium
oxide (Li_{0.32}MnTiO₄) **138017-68-2**, Lithium manganese titanium
oxide (Li_{0.22}Mn_{1.2}Ti_{0.8}O₄) **138017-69-3**, Lithium manganese
titanium oxide (Li_{0.16}Mn_{1.4}Ti_{0.6}O₄) 138017-70-6, Lithium manganese zinc
oxide (Li_{0.12}Mn_{1.95}Zn_{0.05}O₄) 138017-71-7, Lithium manganese nickel oxide
(Li_{0.82}Mn_{1.6}Ni_{0.4}O₄) 138017-72-8, Lithium manganese nickel oxide
(Li_{0.48}Mn_{1.7}Ni_{0.3}O₄) 138017-73-9, Lithium manganese nickel oxide
(Li_{0.34}Mn_{1.8}Ni_{0.2}O₄) 138017-74-0, Lithium manganese nickel oxide
(Li_{0.19}Mn_{1.9}Ni_{0.1}O₄) 138017-75-1, Lithium manganese nickel oxide
(Li_{0.11}Mn_{1.95}Ni_{0.05}O₄) 138017-76-2, Germanium lithium manganese oxide
(Ge_{0.2}Li_{0.01}Mn_{1.8}O₄) 138017-77-3, Iron lithium manganese oxide
(Fe_{0.2}Li_{0.14}Mn_{1.8}O₄) 138017-78-4, Iron lithium manganese oxide
(Fe_{0.1}Li_{0.08}Mn_{1.9}O₄) 138017-79-5, Iron lithium manganese oxide
(Fe_{0.05}Li_{0.07}Mn_{1.95}O₄) 138017-80-8, Lithium manganese zinc oxide
(Li_{0.36}Mn_{1.8}Zn_{0.2}O₄) 138017-81-9, Lithium manganese zinc oxide
(Li_{0.23}Mn_{1.9}Zn_{0.1}O₄) **138728-44-6**, Lithium manganese titanium
oxide (Li_{0.17}Mn_{1.6}Ti_{0.4}O₄)
RL: PRP (Properties)
(cubic lattice parameter and unit cell volume for, after lithium removal
by acid leaching)
- IT 108-32-7, Propylene carbonate
RL: PRP (Properties)
(cycling behavior of lithium manganese oxide in, in lithium cell at
different temps.)
- IT 137972-91-9, Lithium manganese nickel oxide (Li_{0.11}-0.82Mn_{1.6}-1.95Ni_{0.05}-
0.4O₄) 137972-92-0, Lithium manganese zinc oxide (Li_{0.12}-0.36Mn_{1.8}-
1.95Zn_{0.05}-0.2O₄) 137972-93-1, Iron lithium manganese oxide
(Fe_{0.05}-0.2Li_{0.07}-0.14Mn_{1.8}-1.95O₄) 137972-94-2, Germanium lithium
manganese oxide (Ge_{0.05}-0.2Li_{0.01}-0.03Mn_{1.8}-1.95O₄) **137972-95-3**,
Lithium manganese titanium oxide (Li_{0.02}-0.32Mn_{1.2}Ti_{0.1}O₄)
RL: PRP (Properties)
(electrochem. properties and cubic lattice parameters and unit cell
vols. for)
- IT 1313-13-9P, Manganese dioxide, preparation
RL: PREP (Preparation)
(formation of λ-, from leaching of lithium from lithium
manganese oxide, **cathode** in secondary lithium cells in
relation to)
- IT 138017-82-0P, Lithium manganese nickel oxide (Li_{0.83}Mn_{1.6}Ni_{0.4}O_{3.99})
138017-83-1P, Lithium manganese nickel oxide (Li_{0.4}Mn_{1.78}Ni_{0.21}O_{4.02})
138017-84-2P, Lithium manganese titanium oxide (Li_{0.4}Mn_{1.2}Ti_{0.8}O₄)
138017-85-3P, Lithium manganese titanium oxide
(Li_{0.2}Mn_{1.61}Ti_{0.39}O_{4.04}) **138017-86-4P**, Lithium manganese
titanium oxide (Li_{0.18}Mn_{1.7}Ti_{0.24}O_{3.96})
RL: PREP (Preparation)
(preparation of, acid leaching in, plasma emission in relation to)
- IT 12057-17-9, Lithium manganese oxide (LiMn₂O₄)
RL: PRP (Properties)
(**spinel** phase of, as **cathode** in secondary lithium
cells)
- IT **137972-96-4**, Lithium manganese titanium oxide (Li_{0.17}Mn_{1.5}Ti_{0.5}O₄)

137972-97-5, Lithium manganese titanium oxide (Li_{0.16}Mn_{1.7}Ti_{0.3}O₄)

137972-98-6, Lithium manganese titanium oxide (Li_{0.14}Mn_{1.8}Ti_{0.2}O₄)

137972-99-7, Lithium manganese titanium oxide (Li_{0.07}Mn_{1.9}Ti_{0.1}O₄)

138017-64-8, Lithium manganese titanium oxide

(Li_{0.06}Mn_{1.95}Ti_{0.05}O₄) 138017-67-1, Lithium manganese titanium

oxide (Li_{0.32}MnTiO₄) 138017-68-2, Lithium manganese titanium

oxide (Li_{0.22}Mn_{1.2}Ti_{0.8}O₄) 138017-69-3, Lithium manganese

titanium oxide (Li_{0.16}Mn_{1.4}Ti_{0.6}O₄) 138728-44-6, Lithium

manganese titanium oxide (Li_{0.17}Mn_{1.6}Ti_{0.4}O₄)

RL: PRP (Properties)

(cubic lattice parameter and unit cell volume for, after lithium removal
by acid leaching)

RN 137972-96-4 HCA

CN Lithium manganese titanium oxide (Li_{0.17}Mn_{1.5}Ti_{0.5}O₄) (9CI) (CA INDEX
NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.5	7440-32-6
Mn	1.5	7439-96-5
Li	0.17	7439-93-2

RN 137972-97-5 HCA

CN Lithium manganese titanium oxide (Li_{0.16}Mn_{1.7}Ti_{0.3}O₄) (9CI) (CA INDEX
NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.3	7440-32-6
Mn	1.7	7439-96-5
Li	0.16	7439-93-2

RN 137972-98-6 HCA

CN Lithium manganese titanium oxide (Li_{0.14}Mn_{1.8}Ti_{0.2}O₄) (9CI) (CA INDEX
NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.2	7440-32-6
Mn	1.8	7439-96-5
Li	0.14	7439-93-2

RN 137972-99-7 HCA

CN Lithium manganese titanium oxide (Li_{0.07}Mn_{1.9}Ti_{0.1}O₄) (9CI) (CA INDEX
NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.1	7440-32-6
Mn	1.9	7439-96-5

Li | 0.07 | 7439-93-2

RN 138017-64-8 HCA

CN Lithium manganese titanium oxide (Li_{0.06}Mn_{1.95}Ti_{0.05}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.05	7440-32-6
Mn	1.95	7439-96-5
Li	0.06	7439-93-2

RN 138017-67-1 HCA

CN Lithium manganese titanium oxide (Li_{0.32}MnTiO₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	1	7440-32-6
Mn	1	7439-96-5
Li	0.32	7439-93-2

RN 138017-68-2 HCA

CN Lithium manganese titanium oxide (Li_{0.22}Mn_{1.2}Ti_{0.8}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.8	7440-32-6
Mn	1.2	7439-96-5
Li	0.22	7439-93-2

RN 138017-69-3 HCA

CN Lithium manganese titanium oxide (Li_{0.16}Mn_{1.4}Ti_{0.6}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.6	7440-32-6
Mn	1.4	7439-96-5
Li	0.16	7439-93-2

RN 138728-44-6 HCA

CN Lithium manganese titanium oxide (Li_{0.17}Mn_{1.6}Ti_{0.4}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.4	7440-32-6

Mn		1.6		7439-96-5
Li		0.17		7439-93-2

IT 137972-95-3, Lithium manganese titanium oxide (Li_{0.02}-0.32Mn₁-2Ti₀-104)
 RL: PRP (Properties)
 (electrochem. properties and cubic lattice parameters and unit cell vols. for)
 RN 137972-95-3 HCA
 CN Lithium manganese titanium oxide (Li_{0.02}-0.32Mn₁-2Ti₀-104) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0 - 1	7440-32-6
Mn	1 - 2	7439-96-5
Li	0.02 - 0.32	7439-93-2

IT 138017-84-2P, Lithium manganese titanium oxide (Li_{0.4}Mn₁.2Ti₀.804)
 138017-85-3P, Lithium manganese titanium oxide
 (Li_{0.2}Mn₁.61Ti₀.3904.04) 138017-86-4P, Lithium manganese
 titanium oxide (Li_{0.18}Mn₁.7Ti₀.2403.96)
 RL: PREP (Preparation)
 (preparation of, acid leaching in, plasma emission in relation to)
 RN 138017-84-2 HCA
 CN Lithium manganese titanium oxide (Li_{0.4}Mn₁.2Ti₀.804) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.8	7440-32-6
Mn	1.2	7439-96-5
Li	0.4	7439-93-2

RN 138017-85-3 HCA
 CN Lithium manganese titanium oxide (Li_{0.2}Mn₁.61Ti₀.3904.04) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4.04	17778-80-2
Ti	0.39	7440-32-6
Mn	1.61	7439-96-5
Li	0.2	7439-93-2

RN 138017-86-4 HCA
 CN Lithium manganese titanium oxide (Li_{0.18}Mn₁.7Ti₀.2403.96) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	3.96	17778-80-2

Ti		0.24		7440-32-6
Mn		1.7		7439-96-5
Li		0.18		7439-93-2

=> d L53 1-13 ti

L53 ANSWER 1 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Lithium secondary battery with lithium manganese oxide **cathode**

L53 ANSWER 2 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Secondary lithium battery and its manufacture

L53 ANSWER 3 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI **Cathode** intercalation compositions for lithium secondary batteries

L53 ANSWER 4 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI **Cathode** active mass for secondary nonaqueous electrolyte lithium batteries and the batteries

L53 ANSWER 5 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Secondary lithium batteries

L53 ANSWER 6 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Lithium secondary battery

L53 ANSWER 7 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Secondary lithium batteries

L53 ANSWER 8 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Solid-state redox potentials for $\text{Li}[\text{Me}_{1/2}\text{Mn}_{3/2}]\text{O}_4$ (Me: 3d-transition metal) having **spinel**-framework structures: a series of 5 volt materials for advanced lithium-ion batteries

L53 ANSWER 9 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Local structure and defect chemistry of substituted lithium manganate **spinels**: X-ray absorption and computer simulation studies

L53 ANSWER 10 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Structural and electrical characterization of $\text{Li}(\text{Mn}_{1-8}\text{Ti}_8)\text{O}_4$ **electrode** materials

L53 ANSWER 11 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Multiple-doped oxide **cathode** material for secondary lithium and lithium-ion batteries

L53 ANSWER 12 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Lithium manganese oxide battery **cathodes** with high capacity and stability

L53 ANSWER 13 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Doped Li-Mn **Spinels**: Physical/Chemical Characteristics and Electrochemical Performance in Li Batteries

L53 ANSWER 14 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Nonaqueous electrolyte secondary battery having lithium manganese oxide as a positive **electrode** active mass

L53 ANSWER 15 OF 15 HCA COPYRIGHT 2004 ACS on STN

TI Lithium intercalation in oxides: electromotive force related to structure and chemistry

=> => d L53 1-15 cbib abs hitind hitstr

L53 ANSWER 1 OF 15 HCA COPYRIGHT 2004 ACS on STN

137:297447 Lithium secondary battery with lithium manganese oxide **cathode**. Takahashi, Michio (NGK Insulators, Ltd., Japan). U.S. Pat. Appl. Publ. US 2002150819 A1 20021017, 7 pp., Cont.-in-part of U.S. Ser. No. 613,127, abandoned. (English). CODEN: USXXCO. APPLICATION: US 2002-52226 20020117. PRIORITY: JP 1999-216794 19990730; US 2000-613127 20000710.

AB The title battery has excellent charge and discharge cycle properties. As a pos. active material of a lithium secondary battery, lithium manganese oxide having a cubic **spinel** structure, in which the strength ratio (P2/P1 strength ratio) of the primary endothermal peak (P1) appearing around 950°, and the secondary endothermal peak (P2) appearing around 1100° in DTA is under 1, is used.

IC ICM H01M004-50

ICS H01M004-52; H01M004-58

NCL 429224000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST lithium manganese oxide **cathode** secondary battery

IT Battery **cathodes**

(lithium secondary battery with lithium manganese oxide **cathode**)

IT Secondary batteries

(lithium; lithium secondary battery with lithium manganese oxide **cathode**)

IT 39457-42-6, Lithium manganese oxide

RL: DEV (Device component use); USES (Uses)

(lithium secondary battery with lithium manganese oxide **cathode**)

IT 155472-68-7P, Lithium manganese oxide $\text{Li}_{1.1}\text{Mn}_{1.9}\text{O}_4$ **253868-26-7P**, Lithium manganese nickel titanium oxide $\text{LiMn}_{1.9}\text{Ni}_{0.05}\text{Ti}_{0.05}\text{O}_4$

RL: DEV (Device component use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)

(lithium secondary battery with lithium manganese oxide **cathode**)

IT **253868-26-7P**, Lithium manganese nickel titanium oxide $\text{LiMn}_{1.9}\text{Ni}_{0.05}\text{Ti}_{0.05}\text{O}_4$

RL: DEV (Device component use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)

(lithium secondary battery with lithium manganese oxide **cathode**)

RN 253868-26-7 HCA

CN Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.9}\text{Ni}_{0.05}\text{Ti}_{0.05}\text{O}_4$) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2

Ti		0.05		7440-32-6
Ni		0.05		7440-02-0
Mn		1.9		7439-96-5
Li		1		7439-93-2

L53 ANSWER 2 OF 15 HCA COPYRIGHT 2004 ACS on STN

134:369398 Secondary lithium battery and its manufacture. Kito, Masanobu; Nemoto, Hiroshi (NGK Insulators, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001135302 A2 20010518, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-310645 19991101.

AB The battery has an **electrode** comprising a pair of **electrode** plates laminated or rolled via a separator in a nonaq. electrolytic solution, in which the **cathode** active material is composed of Li manganate to show the resistivity (ρ) of the material layer $\leq 500 \Omega\text{-cm}$ or $\rho \leq 32500/(Y + 1.73) - 8300$ (Y = ion number of Mh based on O number 4) to the thickness direction without impregnation of the electrolytic solution. The battery is manufactured by sandwiching a pair of **electrode** sheet with a pressure to measure the ρ distribution on the sheet, followed by rolling or laminating the **electrode** sheet. The battery is useful for elec. or hybrid vehicles. The battery shows low internal resistivity and uniform product quality.

IC ICM H01M004-02

ICS H01M004-04; H01M004-58; H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST battery nonaq electrolyte lithium manganate **cathode**; **cathode** resistivity battery lithium manganate; cubic **spinel** lithium manganate battery **cathode**

IT Secondary batteries

(button-type, cubic **spinel**; manufacture of secondary lithium battery)

IT Battery **cathodes**

(cubic **spinel**; manufacture of secondary lithium battery)

IT 12057-17-9, Lithium manganate (LiMn_2O_4) 155472-68-7, Lithium manganese oxide ($\text{Li}_{1.1}\text{Mn}_{1.9}\text{O}_4$) 176979-23-0, Lithium manganese oxide ($\text{Li}_{1.15}\text{Mn}_{1.85}\text{O}_4$) **333337-19-2**, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.8}(\text{Ni,Ti})\text{O}_{2.04}$) **333337-21-6**

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(cubic **spinel**; manufacture of secondary lithium battery)

IT **333337-19-2**, Lithium manganese nickel titanium oxide

($\text{LiMn}_{1.8}(\text{Ni,Ti})\text{O}_{2.04}$) **333337-21-6**

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(cubic **spinel**; manufacture of secondary lithium battery)

RN 333337-19-2 HCA

CN Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.8}(\text{Ni,Ti})\text{O}_{2.04}$) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====	+	=====	+	=====
O		4		17778-80-2
Ti		0 - 0.2		7440-32-6
Ni		0 - 0.2		7440-02-0
Mn		1.8		7439-96-5
Li		1		7439-93-2

RN 333337-21-6 HCA

CN Lithium magnesium manganese titanium oxide (Li(Mg,Ti)0.2Mn1.8O4) (9CI)
(CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0 - 0.2	7440-32-6
Mn	1.8	7439-96-5
Mg	0 - 0.2	7439-95-4
Li	1	7439-93-2

L53 ANSWER 3 OF 15 HCA COPYRIGHT 2004 ACS on STN

134:254711 **Cathode** intercalation compositions for lithium secondary batteries. Howard, Wilmont Frederick, Jr.; Sheargold, Stephen Wilfred; Jordan, Monte Sean; Bledsoe, Joe Lane (Kerr-McGee Chemical LLC, USA). PCT Int. Appl. WO 2001024293 A1 20010405, 31 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US26490 20000926. PRIORITY: US 1999-408043 19990929.

AB Intercalation compns. having **spinel** structures with crystallites of metal oxides (M2O3) dispersed throughout the structure are provided having the general formula $Li1+xMyMn2-x-yO4$ where x is >0 but ≤ 0.25 , y is >0 but ≤ 0.5 , and a portion of M is in the crystalline M2O3. Methods of producing the intercalation compns. and rechargeable lithium batteries containing the compns. are also provided.

IC ICM H01M004-50

ICS H01M004-58

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST lithium battery **cathode** intercalation compnIT Battery **cathodes**

(**cathode** intercalation compns. for lithium secondary batteries)

IT Intermetallic compounds

Oxides (inorganic), uses

RL: DEV (Device component use); USES (Uses)

(**cathode** intercalation compns. for lithium secondary batteries)

IT Intercalation compounds

RL: DEV (Device component use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)

(**cathode** intercalation compns. for lithium secondary batteries)

IT Esters, uses

RL: MOA (Modifier or additive use); USES (Uses)

(**cathode** intercalation compns. for lithium secondary batteries)

IT Secondary batteries

(lithium; **cathode** intercalation compns. for lithium secondary

- batteries)
- IT Carbonates, uses
Ethers, uses
Sulfones
RL: MOA (Modifier or additive use); USES (Uses)
(organic; **cathode** intercalation compns. for lithium secondary
batteries)
- IT Lithium alloy, base
RL: DEV (Device component use); USES (Uses)
(**cathode** intercalation compns. for lithium secondary
batteries)
- IT 7439-93-2, Lithium, uses 7440-44-0, Carbon, uses 7791-03-9, Lithium
perchlorate 14283-07-9, Lithium tetrafluoroborate 21324-40-3, Lithium
hexafluorophosphate 29935-35-1, Lithium hexafluoroarsenate 90076-65-6
132404-42-3
RL: DEV (Device component use); USES (Uses)
(**cathode** intercalation compns. for lithium secondary
batteries)
- IT 12057-17-9P, Lithium manganese oxide LiMn_2O_4 145896-60-2P, Aluminum
lithium manganese oxide $\text{Al}_0.2\text{LiMn}_{1.8}\text{O}_4$ 155472-67-6P, Lithium manganese
oxide $\text{Li}_{1.05}\text{Mn}_{1.95}\text{O}_4$ 171827-57-9P, Aluminum lithium manganese oxide
 $\text{Al}_0.12\text{LiMn}_{1.88}\text{O}_4$ 172922-66-6P, Lithium manganese oxide $\text{Li}_{1.04}\text{Mn}_{1.96}\text{O}_4$
172922-68-8P, Lithium manganese oxide $\text{Li}_{1.07}\text{Mn}_{1.93}\text{O}_4$ 178404-39-2P,
Lithium manganese oxide $\text{Li}_{1.09}\text{Mn}_{1.91}\text{O}_4$ 208582-33-6P, Aluminum lithium
manganese oxide $\text{Al}_0.08\text{LiMn}_{1.92}\text{O}_4$ 211230-82-9P, Gallium lithium manganese
oxide $\text{Ga}_0.03\text{LiMn}_{1.97}\text{O}_4$ 220351-16-6P, Chromium lithium manganese oxide
($\text{Cr}_0.12\text{LiMn}_{1.88}\text{O}_4$) 220516-32-5P, Aluminum lithium manganese oxide
 $\text{Al}_0.05\text{LiMn}_{1.95}\text{O}_4$ 220516-34-7P, Aluminum lithium manganese oxide
 $\text{Al}_0.15\text{LiMn}_{1.85}\text{O}_4$ 331278-04-7P, Aluminum lithium manganese oxide
($\text{Al}_0.02\text{Li}_{1.05}\text{Mn}_{1.93}\text{O}_4$) **331278-05-8P**, Lithium manganese titanium
oxide ($\text{Li}_{1.01}\text{Mn}_{1.93}\text{Ti}_{0.06}\text{O}_4$) 331278-06-9P, Aluminum lithium manganese
oxide ($\text{Al}_0.05\text{Li}_{1.05}\text{Mn}_{1.91}\text{O}_4$) 331278-07-0P, Aluminum lithium manganese
oxide ($\text{Al}_0.07\text{Li}_{1.05}\text{Mn}_{1.88}\text{O}_4$) 331278-08-1P, Aluminum lithium manganese
oxide ($\text{Al}_0.12\text{Li}_{1.05}\text{Mn}_{1.83}\text{O}_4$) 331278-09-2P, Aluminum lithium manganese
oxide ($\text{Al}_0.15\text{Li}_{1.05}\text{Mn}_{1.81}\text{O}_4$) 331278-10-5P, Aluminum lithium manganese
oxide ($\text{Al}_0.2\text{Li}_{1.05}\text{Mn}_{1.76}\text{O}_4$) 331278-11-6P, Lithium manganese ruthenium
oxide ($\text{Li}_{1.06}\text{Mn}_{1.93}\text{Ru}_{0.01}\text{O}_4$) 331278-12-7P, Lithium manganese ruthenium
oxide ($\text{Li}_{1.07}\text{Mn}_{1.91}\text{Ru}_{0.02}\text{O}_4$) 331278-13-8P, Chromium lithium manganese
oxide ($\text{Cr}_0.12\text{Li}_{1.05}\text{Mn}_{1.83}\text{O}_4$) 331278-14-9P, Chromium lithium manganese
oxide ($\text{Cr}_0.07\text{Li}_{1.05}\text{Mn}_{1.88}\text{O}_4$) 331278-15-0P, Gallium lithium manganese
oxide ($\text{Ga}_0.01\text{Li}_{1.11}\text{Mn}_{1.88}\text{O}_4$) 331278-16-1P, Aluminum gallium lithium
manganese oxide ($\text{Al}_0.05\text{Ga}_0.01\text{Li}_{1.05}\text{Mn}_{1.90}\text{O}_4$) 331278-19-4P, Gallium
lithium manganese oxide ($\text{Ga}_0.01\text{Li}_{1.03}\text{Mn}_{1.96}\text{O}_4$) 331278-21-8P, Aluminum
lithium manganese oxide ($\text{Al}_0.23\text{Li}_{1.06}\text{Mn}_{1.70}\text{O}_4$) 331278-22-9P, Aluminum
lithium manganese oxide ($\text{Al}_0.29\text{Li}_{1.06}\text{Mn}_{1.64}\text{O}_4$)
RL: DEV (Device component use); SPN (Synthetic preparation); PREP
(Preparation); USES (Uses)
(**cathode** intercalation compns. for lithium secondary
batteries)
- IT 554-13-2, Lithium carbonate 1308-38-9, Chromium oxide Cr_2O_3 , reactions
1317-34-6, Manganese oxide Mn_2O_3 12024-21-4, Gallium oxide (Ga_2O_3)
12036-10-1, Ruthenia 13494-90-1, Gallium nitrate
RL: RCT (Reactant); RACT (Reactant or reagent)
(**cathode** intercalation compns. for lithium secondary
batteries)
- IT **331278-05-8P**, Lithium manganese titanium oxide
($\text{Li}_{1.01}\text{Mn}_{1.93}\text{Ti}_{0.06}\text{O}_4$)
RL: DEV (Device component use); SPN (Synthetic preparation); PREP

(Preparation); USES (Uses)

(cathode intercalation compns. for lithium secondary batteries)

RN 331278-05-8 HCA

CN Lithium manganese titanium oxide (Li_{1.01}Mn_{1.93}Ti_{0.06}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.06	7440-32-6
Mn	1.93	7439-96-5
Li	1.01	7439-93-2

L53 ANSWER 4 OF 15 HCA COPYRIGHT 2004 ACS on STN

134:88777 Cathode active mass for secondary nonaqueous electrolyte lithium batteries and the batteries. Qi, Lu; Yoshida, Gohei; Hirao, Kazuhiko; Honjo, Yukinori (Honjo Chemical Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2001006673 A2 20010112, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-177258 19990623.

AB The cathode active mass is a spinel type Li Mn oxide having 2Li/(Mn+M) at ratio = 1.01-1.30 (where M = Ti, Co, Ni, Fe, Cr, V, a, and/or Mg, with content of M = 0.01-10 mol% of Mn) obtained by mixing LiOH, MnO₂, and a M source in Cl-3 alc., drying the homogeneous mixture, and firing.

IC ICM H01M004-58

ICS H01M004-02; H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST secondary lithium battery substituted manganese oxide cathode

IT Battery cathodes

(compns. of substituted spinel type lithium manganese oxide

cathode active mass for secondary lithium batteries)

IT 130242-31-8, Lithium manganese oxide (Li_{1.05}Mn₂O₄) 317832-14-7,Lithium manganese titanium oxide (Li_{1.05}Mn_{1.94}Ti_{0.06}O₄)

317832-15-8, Lithium manganese titanium oxide

(Li_{1.13}Mn_{1.98}Ti_{0.02}O₄) 317832-16-9, Cobalt lithium manganesetitanium oxide (Co_{0.02}Li_{1.15}Mn_{1.96}Ti_{0.02}O₄) 317832-17-0, Lithiummanganese titanium oxide (Li_{1.1}Mn_{1.98}Ti_{0.02}O₄) 317832-18-1, Aluminumlithium manganese oxide (Al_{0.06}Li_{1.1}Mn_{1.94}O₄) 317832-19-2, Aluminumlithium manganese oxide (Al_{0.02}Li_{1.05}Mn_{1.98}O₄) 317832-20-5,Lithium manganese titanium oxide (Li_{1.05}Mn_{1.98}Ti_{0.02}O₄)

RL: DEV (Device component use); USES (Uses)

(compns. of substituted spinel type lithium manganese oxide

cathode active mass for secondary lithium batteries)

IT 317832-14-7, Lithium manganese titanium oxide

(Li_{1.05}Mn_{1.94}Ti_{0.06}O₄) 317832-15-8, Lithium manganese titaniumoxide (Li_{1.13}Mn_{1.98}Ti_{0.02}O₄) 317832-16-9, Cobalt lithiummanganese titanium oxide (Co_{0.02}Li_{1.15}Mn_{1.96}Ti_{0.02}O₄) 317832-17-0, Lithium manganese titanium oxide (Li_{1.1}Mn_{1.98}Ti_{0.02}O₄)

317832-20-5, Lithium manganese titanium oxide

(Li_{1.05}Mn_{1.98}Ti_{0.02}O₄)

RL: DEV (Device component use); USES (Uses)

(compns. of substituted spinel type lithium manganese oxide

cathode active mass for secondary lithium batteries)

RN 317832-14-7 HCA

CN Lithium manganese titanium oxide (Li_{1.05}Mn_{1.94}Ti_{0.06}O₄) (9CI) (CA INDEX

(NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.06	7440-32-6
Mn	1.94	7439-96-5
Li	1.05	7439-93-2

RN 317832-15-8 HCA

CN Lithium manganese titanium oxide (Li_{1.13}Mn_{1.98}Ti_{0.02}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.02	7440-32-6
Mn	1.98	7439-96-5
Li	1.13	7439-93-2

RN 317832-16-9 HCA

CN Cobalt lithium manganese titanium oxide (Co_{0.02}Li_{1.15}Mn_{1.96}Ti_{0.02}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Co	0.02	7440-48-4
Ti	0.02	7440-32-6
Mn	1.96	7439-96-5
Li	1.15	7439-93-2

RN 317832-17-0 HCA

CN Lithium manganese titanium oxide (Li_{1.1}Mn_{1.98}Ti_{0.02}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.02	7440-32-6
Mn	1.98	7439-96-5
Li	1.1	7439-93-2

RN 317832-20-5 HCA

CN Lithium manganese titanium oxide (Li_{1.05}Mn_{1.98}Ti_{0.02}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.02	7440-32-6
Mn	1.98	7439-96-5
Li	1.05	7439-93-2

L53 ANSWER 5 OF 15 HCA COPYRIGHT 2004 ACS on STN

133:180381 Secondary lithium batteries. Nakajima, Hiroshi; Fujimoto, Hiroyuki; Oshita, Ryuji; Fujitani, Shin; Watanabe, Hiroshi; Noma, Toshiyuki; Nishio, Akiharu (Sanyo Electric Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2000235857 A2 20000829, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-301823 19991025. PRIORITY: JP 1998-375978 19981218.

AB The batteries use **spinel** type Li containing Mn oxide as **cathode** active mass, whose composition falls within $\text{Li}_{0.02-1.1}\text{Mn}_{2-y-z}\text{Ni}_y\text{MzO}_4$ ($\text{M} = \text{Fe}, \text{Co}, \text{Ti}, \text{V}, \text{Mg}, \text{Zn}, \text{Ga}, \text{Nb}, \text{Mo}$, and/or Cu ; $0.25 \leq y \leq 0.60$; $0 < z \leq 0.10$) during charge and discharge.

IC ICM H01M004-58

ICS C01G053-00; H01M004-02; H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST secondary lithium battery manganese nickel oxide **cathode**;

spinel type lithium manganese oxide battery **cathode**

IT Battery **cathodes**

(comps. of **spinel** type substituted lithium manganese oxides for **cathodes** in secondary lithium batteries)

IT 288387-79-1, Lithium magnesium manganese nickel oxide ($\text{LiMg}_{0.05}\text{Mn}_{1.55}\text{Ni}_{0.40}\text{O}_4$) 288387-80-4, Iron lithium manganese nickel oxide ($\text{Fe}_{0.05}\text{LiMn}_{1.55}\text{Ni}_{0.40}\text{O}_4$) 288387-81-5, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.05}\text{LiMn}_{1.55}\text{Ni}_{0.40}\text{O}_4$) 288387-82-6, Lithium manganese nickel zinc oxide ($\text{LiMn}_{1.55}\text{Ni}_{0.4}\text{Zn}_{0.05}\text{O}_4$) 288387-83-7, Gallium lithium manganese nickel oxide ($\text{Ga}_{0.05}\text{LiMn}_{1.55}\text{Ni}_{0.40}\text{O}_4$) 288387-84-8, Lithium manganese nickel niobium oxide ($\text{LiMn}_{1.55}\text{Ni}_{0.4}\text{Nb}_{0.05}\text{O}_4$) 288387-85-9 288387-86-0, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.55}\text{Ni}_{0.4}\text{Ti}_{0.05}\text{O}_4$) 288387-87-1, Lithium manganese nickel vanadium oxide ($\text{LiMn}_{1.55}\text{Ni}_{0.4}\text{V}_{0.05}\text{O}_4$) 288387-88-2, Copper lithium manganese nickel oxide ($\text{Cu}_{0.05}\text{LiMn}_{1.55}\text{Ni}_{0.40}\text{O}_4$) 288387-89-3, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.05}\text{LiMn}_{1.7}\text{Ni}_{0.25}\text{O}_4$) 288387-90-6, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.05}\text{LiMn}_{1.65}\text{Ni}_{0.30}\text{O}_4$) 288387-91-7, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.05}\text{LiMn}_{1.45}\text{Ni}_{0.50}\text{O}_4$) 288387-92-8, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.05}\text{LiMn}_{1.35}\text{Ni}_{0.60}\text{O}_4$) 288387-93-9, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.7}\text{Ni}_{0.25}\text{Ti}_{0.05}\text{O}_4$) 288387-94-0, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.65}\text{Ni}_{0.3}\text{Ti}_{0.05}\text{O}_4$) 288387-95-1, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.45}\text{Ni}_{0.5}\text{Ti}_{0.05}\text{O}_4$) 288387-96-2, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.35}\text{Ni}_{0.6}\text{Ti}_{0.05}\text{O}_4$) 288387-97-3, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.01}\text{LiMn}_{1.59}\text{Ni}_{0.40}\text{O}_4$) 288387-98-4, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.03}\text{LiMn}_{1.57}\text{Ni}_{0.40}\text{O}_4$) 288387-99-5, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.08}\text{LiMn}_{1.52}\text{Ni}_{0.40}\text{O}_4$) 288388-00-1, Cobalt lithium manganese nickel oxide ($\text{Co}_{0.1}\text{LiMn}_{1.5}\text{Ni}_{0.40}\text{O}_4$) 288388-01-2, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.59}\text{Ni}_{0.4}\text{Ti}_{0.01}\text{O}_4$) 288388-02-3, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.57}\text{Ni}_{0.4}\text{Ti}_{0.03}\text{O}_4$) 288388-03-4, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.52}\text{Ni}_{0.4}\text{Ti}_{0.08}\text{O}_4$) 288388-04-5, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.5}\text{Ni}_{0.4}\text{Ti}_{0.10}\text{O}_4$)

RL: DEV (Device component use); USES (Uses)

(comps. of **spinel** type substituted lithium manganese oxides for **cathodes** in secondary lithium batteries)

IT 288387-86-0, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.55}\text{Ni}_{0.4}\text{Ti}_{0.05}\text{O}_4$) 288387-93-9, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.7}\text{Ni}_{0.25}\text{Ti}_{0.05}\text{O}_4$) 288387-94-0, Lithium manganese nickel titanium oxide ($\text{LiMn}_{1.65}\text{Ni}_{0.3}\text{Ti}_{0.05}\text{O}_4$)

288387-95-1, Lithium manganese nickel titanium oxide
 (LiMn_{1.45}Ni_{0.5}Ti_{0.05}O₄) 288387-96-2, Lithium manganese nickel
 titanium oxide (LiMn_{1.35}Ni_{0.6}Ti_{0.05}O₄) 288388-01-2, Lithium
 manganese nickel titanium oxide (LiMn_{1.59}Ni_{0.4}Ti_{0.01}O₄)
 288388-02-3, Lithium manganese nickel titanium oxide
 (LiMn_{1.57}Ni_{0.4}Ti_{0.03}O₄) 288388-03-4, Lithium manganese nickel
 titanium oxide (LiMn_{1.52}Ni_{0.4}Ti_{0.08}O₄) 288388-04-5, Lithium
 manganese nickel titanium oxide (LiMn_{1.5}Ni_{0.4}Ti_{0.1}O₄)
 RL: DEV (Device component use); USES (Uses)
 (comps. of **spinel** type substituted lithium manganese oxides
 for **cathodes** in secondary lithium batteries)

RN 288387-86-0 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.55}Ni_{0.4}Ti_{0.05}O₄) (9CI) (CA
 INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.05	7440-32-6
Ni	0.4	7440-02-0
Mn	1.55	7439-96-5
Li	1	7439-93-2

RN 288387-93-9 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.7}Ni_{0.25}Ti_{0.05}O₄) (9CI) (CA
 INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.05	7440-32-6
Ni	0.25	7440-02-0
Mn	1.7	7439-96-5
Li	1	7439-93-2

RN 288387-94-0 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.65}Ni_{0.3}Ti_{0.05}O₄) (9CI) (CA
 INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.05	7440-32-6
Ni	0.3	7440-02-0
Mn	1.65	7439-96-5
Li	1	7439-93-2

RN 288387-95-1 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.45}Ni_{0.5}Ti_{0.05}O₄) (9CI) (CA
 INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2

Ti		0.05		7440-32-6
Ni		0.5		7440-02-0
Mn		1.45		7439-96-5
Li		1		7439-93-2

RN 288387-96-2 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.35}Ni_{0.6}Ti_{0.05}O₄) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
O		4		17778-80-2
Ti		0.05		7440-32-6
Ni		0.6		7440-02-0
Mn		1.35		7439-96-5
Li		1		7439-93-2

RN 288388-01-2 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.59}Ni_{0.4}Ti_{0.01}O₄) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
O		4		17778-80-2
Ti		0.01		7440-32-6
Ni		0.4		7440-02-0
Mn		1.59		7439-96-5
Li		1		7439-93-2

RN 288388-02-3 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.57}Ni_{0.4}Ti_{0.03}O₄) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
O		4		17778-80-2
Ti		0.03		7440-32-6
Ni		0.4		7440-02-0
Mn		1.57		7439-96-5
Li		1		7439-93-2

RN 288388-03-4 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.52}Ni_{0.4}Ti_{0.08}O₄) (9CI) (CA INDEX NAME)

Component		Ratio		Component Registry Number
=====				
O		4		17778-80-2
Ti		0.08		7440-32-6
Ni		0.4		7440-02-0
Mn		1.52		7439-96-5
Li		1		7439-93-2

RN 288388-04-5 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.5}Ni_{0.4}Ti_{0.104}) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.1	7440-32-6
Ni	0.4	7440-02-0
Mn	1.5	7439-96-5
Li	1	7439-93-2

I53 ANSWER 6 OF 15 HCA COPYRIGHT 2004 ACS on STN

132:253603 Lithium secondary battery. Nemoto, Hiroshi; Kito, Kenshin (NGK Insulators, Ltd., Japan). Eur. Pat. Appl. EP 993058 A1 20000412, 11 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO. (English). CODEN: EPXXDW. APPLICATION: EP 1999-119454 19990930. PRIORITY: JP 1998-294559 19981001.

AB A lithium secondary battery includes a **cathode** active material which is composed mainly of Li and Mn and has a cubic **spinel** structure, the primary particles of the **cathode** active material having a substantially octahedral shape constituted mainly by flat crystal faces. In this lithium secondary battery, the morphol. of the particles constituting the **cathode** active material is controlled; thereby, the resistance of the pos. **electrode** active material and accordingly the internal resistance of the battery are lowered; as a result, discharge in large current has been made possible.

IC ICM H01M004-50

ICS H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT Battery **cathodes**

(lithium battery **cathode** active material of controlled shape)

IT Secondary batteries

(lithium; lithium battery **cathode** active material of controlled shape)

IT **253868-27-8**, Lithium manganese nickel titanium oxide (LiMn_{1.85}Ni_{0.08}Ti_{0.0804})

RL: DEV (Device component use); USES (Uses)

(lithium battery **cathode** active material of controlled shape)

IT **253868-27-8**, Lithium manganese nickel titanium oxide (LiMn_{1.85}Ni_{0.08}Ti_{0.0804})

RL: DEV (Device component use); USES (Uses)

(lithium battery **cathode** active material of controlled shape)

RN 253868-27-8 HCA

CN Lithium manganese nickel titanium oxide (LiMn_{1.85}Ni_{0.08}Ti_{0.0804}) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.08	7440-32-6
Ni	0.08	7440-02-0
Mn	1.85	7439-96-5
Li	1	7439-93-2

L53 ANSWER 7 OF 15 HCA COPYRIGHT 2004 ACS on STN
132:168769 Secondary lithium batteries. Takahashi, Michio (NGK Insulators, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2000067861 A2 20000303, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1998-240234 19980826.
AB The batteries use Ti substituted cubic **spinel** type $\text{LiTi}_x\text{Mn}_{2-x}\text{O}_4$ as **cathode** active mass. The batteries are useful for elec. or hybrid automobiles.
IC ICM H01M004-58
ICS C01G045-12; H01M004-02; H01M010-40
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST automobile secondary lithium battery **cathode**; battery lithium manganese titanium oxide **cathode**
IT Battery **cathodes**
(**cathodes** from titanium substituted cubic **spinel** type lithium manganese oxides for secondary lithium batteries)
IT 147812-16-6, Lithium manganese titanium oxide ($\text{LiMn}_{1.5}\text{Ti}_{0.5}\text{O}_4$)
177988-73-7, Lithium manganese titanium oxide ($\text{LiMn}_{1.9}\text{Ti}_{0.1}\text{O}_4$)
209470-20-2, Lithium manganese titanium oxide ($\text{LiMn}_{1.99}\text{Ti}_{0.01}\text{O}_4$)
258519-82-3, Lithium manganese titanium oxide ($\text{LiMn}_{1.85}\text{Ti}_{0.15}\text{O}_4$)
258519-83-4, Lithium manganese titanium oxide ($\text{LiMn}_{1.7}\text{Ti}_{0.3}\text{O}_4$)
RL: DEV (Device component use); USES (Uses)
(**cathodes** from titanium substituted cubic **spinel** type lithium manganese oxides for secondary lithium batteries)
IT 147812-16-6, Lithium manganese titanium oxide ($\text{LiMn}_{1.5}\text{Ti}_{0.5}\text{O}_4$)
177988-73-7, Lithium manganese titanium oxide ($\text{LiMn}_{1.9}\text{Ti}_{0.1}\text{O}_4$)
209470-20-2, Lithium manganese titanium oxide ($\text{LiMn}_{1.99}\text{Ti}_{0.01}\text{O}_4$)
258519-82-3, Lithium manganese titanium oxide ($\text{LiMn}_{1.85}\text{Ti}_{0.15}\text{O}_4$)
258519-83-4, Lithium manganese titanium oxide ($\text{LiMn}_{1.7}\text{Ti}_{0.3}\text{O}_4$)
RL: DEV (Device component use); USES (Uses)
(**cathodes** from titanium substituted cubic **spinel** type lithium manganese oxides for secondary lithium batteries)
RN 147812-16-6 HCA
CN Lithium manganese titanium oxide ($\text{LiMn}_{1.5}\text{Ti}_{0.5}\text{O}_4$) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.5	7440-32-6
Mn	1.5	7439-96-5
Li	1	7439-93-2

RN 177988-73-7 HCA
CN Lithium manganese titanium oxide ($\text{LiMn}_{1.9}\text{Ti}_{0.1}\text{O}_4$) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.1	7440-32-6
Mn	1.9	7439-96-5
Li	1	7439-93-2

RN 209470-20-2 HCA
CN Lithium manganese titanium oxide ($\text{LiMn}_{1.99}\text{Ti}_{0.01}\text{O}_4$) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
-----------	-------	------------------------------

O	4	17778-80-2
Ti	0.01	7440-32-6
Mn	1.99	7439-96-5
Li	1	7439-93-2

RN 258519-82-3 HCA

CN Lithium manganese titanium oxide (LiMn_{1.85}Ti_{0.15}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.15	7440-32-6
Mn	1.85	7439-96-5
Li	1	7439-93-2

RN 258519-83-4 HCA

CN Lithium manganese titanium oxide (LiMn_{1.7}Ti_{0.3}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.3	7440-32-6
Mn	1.7	7439-96-5
Li	1	7439-93-2

L53 ANSWER 8 OF 15 HCA COPYRIGHT 2004 ACS on STN

131:288725 Solid-state redox potentials for Li[Me₁/2Mn₃/2]O₄ (Me: 3d-transition metal) having **spinel**-framework structures: a series of 5 volt materials for advanced lithium-ion batteries. Ohzuku, Tsutomu; Takeda, Sachio; Iwanaga, Masato (Faculty of Engineering, Department of Applied Chemistry, Electrochemistry and Inorganic Chemistry Laboratory, Osaka City University, Sumiyoshi, Osaka, Japan). Journal of Power Sources, 81-82, 90-94 (English) 1999. CODEN: JPSODZ. ISSN: 0378-7753. Publisher: Elsevier Science S.A..

AB A series of **spinel**-framework structures of Li[Me₁/2Mn₃/2]O₄ (Me; Ti, Cr, Fe, Co, Ni, Cu, and Zn) was prepared and examined by XRD and electrochem. methods. All samples except Li[Ti₁/2Mn₃/2]O₄ and Li[Zn₁/2Mn₃/2]O₄ exhibited approx. 5 V solid-state redox potentials (vs. Li⁺/Li), probably due mainly to compact crystal fields imposed by the **spinel**-framework structure of cubic close-packed oxygen linked with tetravalent manganese ions. Of these, Li[Fe₁/2Mn₃/2]O₄ and Li[Ni₁/2Mn₃/2]O₄ are very attractive materials in both basic and applied research fields, and the solid-state redox potentials of transition metal ions in such crystal fields are summarized and discussed.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 72

ST redox potential **electrode** lithium battery; lithium transition
metal manganese oxide **electrode**

IT Secondary batteries

(lithium; solid-state redox potentials for Li[Me₁/2Mn₃/2]O₄ (Me: 3d-transition metal) having **spinel**-framework structures: a series of 5 V materials for advanced lithium-ion batteries)

IT Battery **electrodes**
Redox potential

(solid-state redox potentials for Li[Me₁/2Mn₃/2]O₄ (Me: 3d-transition metal) having **spinel**-framework structures: a series of 5 V materials for advanced lithium-ion batteries)

IT 12016-91-0, Cobalt lithium manganese oxide Co_{0.5}LiMn_{1.5}O₄ 12019-01-1, Copper lithium manganese oxide (CuLi₂Mn₃O₈) 12031-75-3, Lithium manganese nickel oxide (Li₂Mn₃NiO₈) 12031-76-4, Lithium manganese zinc oxide LiMn_{1.5}Zn_{0.5}O₄ 106389-48-4, Iron lithium manganese oxide (FeLi₂Mn₃O₈) **147812-16-6**, Lithium manganese titanium oxide LiMn_{1.5}Ti_{0.5}O₄ 171261-66-8, Chromium Lithium manganese oxide Cr_{0.5}LiMn_{1.5}O₄

RL: DEV (Device component use); USES (Uses)
(solid-state redox potentials for Li[Me₁/2Mn₃/2]O₄ (Me: 3d-transition metal) having **spinel**-framework structures: a series of 5 V materials for advanced lithium-ion batteries)

IT **147812-16-6**, Lithium manganese titanium oxide LiMn_{1.5}Ti_{0.5}O₄

RL: DEV (Device component use); USES (Uses)
(solid-state redox potentials for Li[Me₁/2Mn₃/2]O₄ (Me: 3d-transition metal) having **spinel**-framework structures: a series of 5 V materials for advanced lithium-ion batteries)

RN 147812-16-6 HCA

CN Lithium manganese titanium oxide (LiMn_{1.5}Ti_{0.5}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.5	7440-32-6
Mn	1.5	7439-96-5
Li	1	7439-93-2

L53 ANSWER 9 OF 15 HCA COPYRIGHT 2004 ACS on STN

131:274090 Local structure and defect chemistry of substituted lithium manganate **spinel**s: X-ray absorption and computer simulation studies. Amundsen, Brett; Islam, M. Saiful; Jones, Deborah J.; Roziere, Jacques (Laboratoire des Agregats Moleculaires et Materiaux Inorganiques ESA CNRS 5072, Universite Montpellier 2, Montpellier, 34095, Fr.). Journal of Power Sources, 81-82, 500-504 (English) **1999**. CODEN: JPSODZ. ISSN: 0378-7753. Publisher: Elsevier Science S.A..

AB The charge distributions and effects on local structure resulting from substitution of Mn by Ti, Cr, Co and Ga in LiMn₂O₄ are determined by X-ray absorption spectroscopy. Atomistic simulation methods are used to obtain addnl. insights into local structure and to calculate the energetics of lithium disorder and migration in lattices containing these substitutional ions or Li on octahedral Mn sites. The formation of protonic species in **spinel** lithium manganates is discussed in relation to a tetrahedral-octahedral vacancy pair model.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 75

ST battery **cathode** lithium manganate **spinel**; defect chem
lithium manganate **spinel**

IT Battery **cathodes**
Defects in solids
Disorder
EXAFS spectra
Simulation and Modeling, physicochemical
(x-ray absorption and computer simulation studies of local structure and defect chemical of substituted lithium manganate **spinel**s)

IT 12016-91-0, Cobalt lithium manganese oxide $\text{Co}_{0.5}\text{LiMn}_{1.5}\text{O}_4$ 12017-95-7, Chromium lithium manganese oxide CrLiMnO_4 12057-17-9, Lithium manganese oxide LiMn_2O_4 **147812-16-6**, Lithium manganese titanium oxide $\text{LiMn}_{1.5}\text{Ti}_{0.5}\text{O}_4$ 171261-66-8, Chromium lithium manganese oxide $\text{Cr}_{0.5}\text{LiMn}_{1.5}\text{O}_4$ 245421-46-9, Gallium lithium manganese oxide ($\text{Ga}_{0.5}\text{LiMn}_{1.5}\text{O}_4$)
 RL: DEV (Device component use); PRP (Properties); USES (Uses)
 (x-ray absorption and computer simulation studies of local structure and defect chemical of substituted lithium manganate **spinel**s)

IT **147812-16-6**, Lithium manganese titanium oxide $\text{LiMn}_{1.5}\text{Ti}_{0.5}\text{O}_4$
 RL: DEV (Device component use); PRP (Properties); USES (Uses)
 (x-ray absorption and computer simulation studies of local structure and defect chemical of substituted lithium manganate **spinel**s)

RN 147812-16-6 HCA

CN Lithium manganese titanium oxide ($\text{LiMn}_{1.5}\text{Ti}_{0.5}\text{O}_4$) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.5	7440-32-6
Mn	1.5	7439-96-5
Li	1	7439-93-2

L53 ANSWER 10 OF 15 HCA COPYRIGHT 2004 ACS on STN

130:54764 Structural and electrical characterization of $\text{Li}(\text{Mn}_{1-8}\text{Ti}_8)\text{O}_{20}$ **electrode** materials. Yoo, Kwang Soo; Cho, Nam Woong; Oh, Yong-Joo (Department of Materials Science and Engineering, The University of Seoul, Seoul, 130-743, S. Korea). Solid State Ionics, 113-115, 43-49 (English) **1998**. CODEN: SSIOD3. ISSN: 0167-2738. Publisher: Elsevier Science B.V..

AB The **spinel** $\text{Li}(\text{Mn}_{1-8}\text{Ti}_8)\text{O}_{20}$ **electrode** materials were synthesized by solid state reaction. The crystal structure and elec. properties of $\text{Li}(\text{Mn}_{1-8}\text{Ti}_8)\text{O}_{20}$ were characterized by Rietveld method and impedance anal., resp. The Mn_{304} second phase was shown in all samples. The titanium was dissolved in Mn 16d-site, and the lattice consts. increased and the elec. conductivity decreased with increasing

titanium content. From the impedance anal., the contribution of grain, grain boundary, and **electrode** was identified. The charge and discharge test was also performed.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST lithium manganese titanium oxide **cathode** characterization;

battery lithium manganese titanium oxide **cathode**

IT Battery **cathodes**

Electric impedance

(structural and elec. characterization of lithium manganese titanium oxide **cathode** materials)

IT 12057-17-9, Lithium manganese oxide (LiMn_2O_4)

RL: DEV (Device component use); USES (Uses)

(structural and elec. characterization of lithium manganese oxide **cathode** materials)

IT **152013-71-3**, Lithium manganese titanium oxide ($\text{LiMn}_{1.8}\text{Ti}_{0.2}\text{O}_4$)

177988-73-7, Lithium manganese titanium oxide ($\text{LiMn}_{1.9}\text{Ti}_{0.1}\text{O}_4$)

203126-27-6, Lithium manganese titanium oxide ($\text{LiMn}_{1.6}\text{Ti}_{0.4}\text{O}_4$)

RL: DEV (Device component use); USES (Uses)

(structural and elec. characterization of lithium manganese titanium

oxide **cathode** materials)
IT 152013-71-3, Lithium manganese titanium oxide (LiMn1.8Ti0.2O4)
177988-73-7, Lithium manganese titanium oxide (LiMn1.9Ti0.1O4)
203126-27-6, Lithium manganese titanium oxide (LiMn1.6Ti0.4O4)
RL: DEV (Device component use); USES (Uses)
(structural and elec. characterization of lithium manganese titanium
oxide **cathode** materials)
RN 152013-71-3 HCA
CN Lithium manganese titanium oxide (LiMn1.8Ti0.2O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.2	7440-32-6
Mn	1.8	7439-96-5
Li	1	7439-93-2

RN 177988-73-7 HCA
CN Lithium manganese titanium oxide (LiMn1.9Ti0.1O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.1	7440-32-6
Mn	1.9	7439-96-5
Li	1	7439-93-2

RN 203126-27-6 HCA
CN Lithium manganese titanium oxide (LiMn1.6Ti0.4O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.4	7440-32-6
Mn	1.6	7439-96-5
Li	1	7439-93-2

L53 ANSWER 11 OF 15 HCA COPYRIGHT 2004 ACS on STN

129:219005 Multiple-doped oxide **cathode** material for secondary
lithium and lithium-ion batteries. Faulkner, Titus; Barnette, Wayne; Gao,
Yuan; Manev, Vesselin (Fmc Corp., USA). PCT Int. Appl. WO 9838648 A1
19980903, 24 pp. DESIGNATED STATES: W: JP. (English). CODEN:
PIXXD2. APPLICATION: WO 1998-US3847 19980227. PRIORITY: US 1997-39666
19970228.

AB The **cathode** material exhibiting good cycling performance,
reversible sp. capacity, and structural stability comprises
Li1+pMn2-qMaM1bMkkO4+z having a **spinel** structure and where M,
M2, ...Mk are ≥ 2 cations different than Li or Mn, selected from the
alkaline earth metals, transition metals, B, Al, Si, Ga, and Ge; p, q, a, b,
...k are molar parts with nos. between 0 and 0.2; a, b, and q are >0 ; z is
 -0.1 to 0.2 ; and where the metals M, M1, ...Mk and the corresponding molar
parts a, b, ...k satisfy the equation and inequality: $q = p + a + b + \dots$
 $+ k$ and $3.3 < (aV + bV1 + \dots + kVk) : (a + b + \dots + k) < 3.7$, where V, V1,
...Vk are the corresponding valence states of the cations M, M1, ...Mk.

IC ICM H01B001-00
ICS H01M004-50
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49
ST lithium ion battery **cathode** material; oxide multiple doped
lithium battery **cathode**
IT Battery **cathodes**
(multiple-doped oxide material for secondary lithium and lithium-ion)
IT **212634-71-4P**, Cobalt lithium manganese titanium oxide
(Co0.01Li1.05Mn1.93Ti0.01O4) **212634-72-5P**, Cobalt lithium
manganese titanium oxide (Co0.01Li1.03Mn1.95Ti0.01O4)
RL: DEV (Device component use); PNU (Preparation, unclassified); PREP
(Preparation); USES (Uses)
(for **cathodes** for secondary lithium and lithium-ion
batteries)
IT **212634-71-4P**, Cobalt lithium manganese titanium oxide
(Co0.01Li1.05Mn1.93Ti0.01O4) **212634-72-5P**, Cobalt lithium
manganese titanium oxide (Co0.01Li1.03Mn1.95Ti0.01O4)
RL: DEV (Device component use); PNU (Preparation, unclassified); PREP
(Preparation); USES (Uses)
(for **cathodes** for secondary lithium and lithium-ion
batteries)
RN 212634-71-4 HCA
CN Cobalt lithium manganese titanium oxide (Co0.01Li1.05Mn1.93Ti0.01O4) (9CI)
(CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Co	0.01	7440-48-4
Ti	0.01	7440-32-6
Mn	1.93	7439-96-5
Li	1.05	7439-93-2

RN 212634-72-5 HCA
CN Cobalt lithium manganese titanium oxide (Co0.01Li1.03Mn1.95Ti0.01O4) (9CI)
(CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Co	0.01	7440-48-4
Ti	0.01	7440-32-6
Mn	1.95	7439-96-5
Li	1.03	7439-93-2

L53 ANSWER 12 OF 15 HCA COPYRIGHT 2004 ACS on STN
128:117324 Lithium manganese oxide battery **cathodes** with high
capacity and stability. Saidi, Mohamed-yazid; Koksang, Rene (Valence
Technology, Inc., USA; Saidi, Mohamed-Yazid; Koksang, Rene). PCT Int.
Appl. WO 9750136 A1 **19971231**, 36 pp. DESIGNATED STATES: W: AL,
AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES,
FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT,
LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI,
SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, AM, AZ, BY, KG, KZ, MD, RU,

TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English).
 CODEN: PIXXD2. APPLICATION: WO 1997-US9757 19970610. PRIORITY: US
 1996-673649 19960625.

- AB The capacity fading of a LiMn₂O₄ **spinel cathode** active material is decreased by substituting a minor amount of Z for Mn in the LiMn₂O₄ active material, where Z is a 4-valent metal (Sn, Ti, Zr, or Hf) able to form tetravalent chlorides. LiMn₂ZqO₄ active material (p and q are >0, p + q ≈ 2, and q ≥ 9p) is characterized by a lesser rate of capacity loss with cycling as compared to LiMn₂O₄ active material.
- IC ICM H01M004-50
- CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
- ST lithium manganese tin oxide battery **cathode**; titanium manganese lithium oxide battery **cathode**; zirconium manganese lithium oxide battery **cathode**; hafnium manganese lithium oxide battery **cathode**
- IT Battery **cathodes**
 (lithium manganese oxide for high capacity and stability)
- IT **177988-73-7**, Lithium manganese titanium oxide (LiMn_{1.9}Ti_{0.1}O₄)
 RL: DEV (Device component use); PRP (Properties); USES (Uses)
 (for battery **cathodes** with high capacity and stability)
- IT 153327-05-0, Lithium manganese tin oxide 201534-12-5, Lithium manganese zirconium oxide 201534-13-6, Hafnium lithium manganese oxide
 RL: TEM (Technical or engineered material use); USES (Uses)
 (for battery **cathodes** with high capacity and stability)
- IT **177988-73-7**, Lithium manganese titanium oxide (LiMn_{1.9}Ti_{0.1}O₄)
 RL: DEV (Device component use); PRP (Properties); USES (Uses)
 (for battery **cathodes** with high capacity and stability)
- RN 177988-73-7 HCA
- CN Lithium manganese titanium oxide (LiMn_{1.9}Ti_{0.1}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
=====	=====	=====
O	4	17778-80-2
Ti	0.1	7440-32-6
Mn	1.9	7439-96-5
Li	1	7439-93-2

L53 ANSWER 13 OF 15 HCA COPYRIGHT 2004 ACS on STN

126:319371 Doped Li-Mn **Spinel**s: Physical/Chemical Characteristics and Electrochemical Performance in Li Batteries. Pistoia, G.; Antonini, A.; Rosati, R.; Bellitto, C.; Ingo, G. M. (Centro di Studio per la Elettrochimica e la Chimica Fisica delle Interfasi, CNR, Rome, 00161, Italy). Chemistry of Materials, 9(6), 1443-1450 (English) 1997.
 CODEN: CMATEX. ISSN: 0897-4756. Publisher: American Chemical Society.

- AB Several doped **spinel**-type Li-Mn oxides of formula Li_{1+x}MyMn_{2-(x+y)}O_{4+z}, where Mn is partly replaced by Li, Cu, Zn, Ni, Co, Fe, Cr, Ga, Al, B, or Ti, were prepared by a solid-state reaction at 730°. These **spinel**s were investigated by x-ray powder diffraction, thermal anal., slow step voltammetry, and galvanostatic cycling at medium-high rates. Even substitutional levels as low as 0.05 atom/formula unit produce structural effects that are reflected in the electrochem. characteristics. The substituents may occupy either tetrahedral 8a sites or octahedral 16d sites. Examples of the first type of substitution are provided by Ga³⁺ and Zn²⁺, while octahedral sites are preferred by, e.g., Ni²⁺ and Cr³⁺. Cycling at practical rates produces

capacities of .apprx.100 mA-h/g for the best materials with limited capacity losses [(3-6) + 10-2 mA-h/g-cycle]. The lower Mn³⁺ content with respect to undoped **spinel** explains the initially lower capacities.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 ST lithium manganese oxide doped **spinel** characteristic; battery
 doped lithium manganese oxide **cathode**
 IT Battery **cathodes**
 (phys./chemical characteristics and electrochem. performance of doped lithium manganese oxide **spinel cathodes** in lithium batteries)

IT 130242-31-8, Lithium manganese oxide (Li_{1.05}Mn₂O₄) 132825-98-0, Lithium manganese oxide (Li_{1.02}Mn₂O₄) 171088-91-8, Lithium manganese oxide (Li_{1.04}Mn₂O₄) 189166-85-6, Lithium manganese zinc oxide (Li_{1.02}Mn_{1.95}Zn_{0.05}O₄) 189166-86-7, Gallium lithium manganese oxide (Ga_{0.05}Li_{1.02}Mn_{1.95}O₄) **189166-87-8**, Lithium manganese titanium oxide (Li_{1.02}Mn_{1.75}Ti_{0.25}O₄) 189166-88-9, Iron lithium manganese oxide (Fe_{0.25}Li_{1.02}Mn_{1.75}O₄) 189166-90-3, Gallium lithium manganese oxide (Ga_{0.25}Li_{1.02}Mn_{1.75}O₄) 189166-91-4, Cobalt lithium manganese oxide (Co_{0.25}Li_{1.02}Mn_{1.75}O₄) 189166-92-5, Cobalt lithium manganese oxide (Co_{0.05}Li_{1.02}Mn_{1.95}O₄) 189166-94-7, Lithium manganese oxide (Li_{1.07}Mn_{1.95}O₄) 189166-96-9, Lithium manganese nickel oxide (Li_{1.02}Mn_{1.95}Ni_{0.05}O₄) 189166-98-1, Chromium lithium manganese oxide (Cr_{0.05}Li_{1.02}Mn_{1.95}O₄) 189167-01-9, Chromium lithium manganese oxide (Cr_{0.1}Li_{1.02}Mn_{1.90}O₄) **189167-03-1**, Lithium manganese titanium oxide (Li_{1.02}Mn_{1.9}Ti_{0.10}O₄)
 RL: DEV (Device component use); PRP (Properties); USES (Uses)
 (phys./chemical characteristics and electrochem. performance of doped lithium manganese oxide **spinel cathodes** in lithium batteries)

IT **189166-87-8**, Lithium manganese titanium oxide (Li_{1.02}Mn_{1.75}Ti_{0.25}O₄) **189167-03-1**, Lithium manganese titanium oxide (Li_{1.02}Mn_{1.9}Ti_{0.10}O₄)
 RL: DEV (Device component use); PRP (Properties); USES (Uses)
 (phys./chemical characteristics and electrochem. performance of doped lithium manganese oxide **spinel cathodes** in lithium batteries)

RN 189166-87-8 HCA
 CN Lithium manganese titanium oxide (Li_{1.02}Mn_{1.75}Ti_{0.25}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.25	7440-32-6
Mn	1.75	7439-96-5
Li	1.02	7439-93-2

RN 189167-03-1 HCA
 CN Lithium manganese titanium oxide (Li_{1.02}Mn_{1.9}Ti_{0.10}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.1	7440-32-6

Mn		1.9		7439-96-5
Li		1.02		7439-93-2

L53 ANSWER 14 OF 15 HCA COPYRIGHT 2004 ACS on STN

123:148988 Nonaqueous electrolyte secondary battery having lithium manganese oxide as a positive **electrode** active mass. Myasaka, Tsutomu (Fuji Photo Film Co Ltd, Japan). Jpn. Kokai Tokkyo Koho JP 07122299 A2 **19950512** Heisei, 11 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1993-263699 19931021.

AB A Li ion battery comprises a neg. **electrode** active mass of a transition metal oxide and a pos. **electrode** active mass of $\text{Li}_1\text{xMn}_2\text{-yAzO}_4$ ($-1.0 < \text{x} < 1.7$; $0 < \text{y} < 1.2$, $0.02 < \text{z} < 1.0$; A is a metal) having **spinel** structure. The preferred neg. **electrode** active mass is $\text{Li}_\text{x}\text{MO}_\text{j}$ (where M is Ti, V, Mn, Co, Fe, Ni, Nb, and/or Mo; $\text{x} = 0.17\text{-}11.25$; and $\text{j} = 1.6\text{-}4.1$), the crystal structure of which changes in the initial introduction of Li ions and then remains unchanged in subsequent charging-discharging. The preferred electrolytes for the battery are propylene carbonate, ethylene carbonate, di-Et carbonate, and Me propionate.

IC ICM H01M010-40

ICS H01M004-02; H01M004-58

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST lithium manganese oxide **cathode** battery; nonaq electrolyte secondary battery

IT Batteries, secondary

(nonaq. electrolyte secondary battery having lithium manganese oxide as a pos. **electrode** active mass)

IT 96-49-1, Ethylene carbonate 105-58-8, Diethyl carbonate 108-32-7, Propylene carbonate 554-12-1, Methyl propionate
RL: DEV (Device component use); USES (Uses)

(electrolyte; nonaq. electrolyte secondary battery having lithium manganese oxide as a pos. **electrode** active mass)

IT 13568-36-0, Lithium nickel vanadium oxide (LiNiVO_4) 161913-50-4, Cobalt lithium titanium vanadium oxide ($\text{CoLi}_1.03\text{Ti}_0.1\text{V}_0.98\text{O}_4.2$) 161913-52-6, Cobalt lithium manganese vanadium oxide ($\text{CoLi}_1.03\text{Mn}_0.1\text{V}_0.98\text{O}_4.2$) 161913-55-9, Cobalt lithium tungsten vanadium oxide ($\text{CoLi}_1.03\text{W}_0.1\text{V}_0.98\text{O}_4.3$) 161913-56-0, Cobalt lithium tin vanadium oxide ($\text{CoLi}_1.03\text{Sn}_0.1\text{V}_0.99\text{O}_4.2$) 163157-17-3, Cobalt lithium nickel vanadium oxide ($\text{Co}_0.6\text{Li}_1.01\text{Ni}_0.4\text{V}_0.99\text{O}_3.9$) 163157-21-9, Chromium cobalt lithium vanadium oxide ($\text{Cr}_0.1\text{CoLi}_1.03\text{V}_0.98\text{O}_4.6$) 163157-22-0, Cobalt iron lithium vanadium oxide ($\text{CoFe}_0.1\text{Li}_1.03\text{V}_0.98\text{O}_4.2$) 163157-23-1, Cobalt lithium niobium vanadium oxide ($\text{CoLi}_1.03\text{Nb}_0.1\text{V}_0.98\text{O}_4.3$) 167162-85-8, Cobalt lithium molybdenum vanadium oxide ($\text{Co}_0.5\text{Li}_0.01\text{Mo}_0.1\text{V}_0.89\text{O}_4.3$) 167162-86-9, Antimony cobalt lithium vanadium oxide ($\text{Sb}_0.1\text{CoLi}_1.03\text{V}_0.98\text{O}_4.3$) 167162-87-0, Lithium titanium oxide ($\text{LiTiO}_2.3$)
RL: DEV (Device component use); USES (Uses)

(neg. **electrode** active mass; nonaq. electrolyte secondary battery having lithium manganese oxide as a pos. **electrode** active mass)

IT 13596-51-5, Cobalt lithium vanadium oxide (CoLiVO_4)

RL: DEV (Device component use); USES (Uses)

(nonaq. electrolyte secondary battery having lithium manganese oxide as a pos. **electrode** active mass)

IT 167162-88-1, Cobalt lithium manganese oxide ($\text{Co}_0.5\text{Li}_2\text{Mn}_3.5\text{O}_9$)
167162-89-2, Germanium lithium manganese oxide ($\text{Ge}_0.05\text{Li}_0.9\text{Mn}_2.95\text{O}_4$)
167162-90-5, Cobalt lithium manganese oxide ($\text{Co}_0.5\text{Li}_2\text{Mn}_4.5\text{O}_{11}$)
167162-91-6, Lithium manganese nickel oxide ($\text{Li}_2\text{Mn}_4.5\text{Ni}_0.5\text{O}_{11}$)

167162-92-7, Cobalt lithium manganese oxide (Co_{0.5}Li₄Mn_{4.5}O₁₂)
 167162-93-8, Cobalt lithium manganese titanium oxide
 (Co_{0.4}Li₄Mn_{4.5}Ti_{0.1}O₁₂) 167162-94-9, Chromium lithium manganese oxide
 (Cr_{0.2}Li_{1.05}Mn_{1.8}O₄) 167162-95-0, Iron lithium manganese oxide
 (Fe_{0.2}Li_{0.95}Mn_{1.7}O₄) 167162-96-1, Lithium manganese vanadium oxide
 (Li_{1.05}Mn_{1.8}V_{0.1}O₄) 167162-97-2, Lithium manganese scandium oxide
 (Li_{0.98}Mn_{1.7}Sc_{0.3}O₄) 167162-98-3, Lithium manganese molybdenum oxide
 (Li_{1.03}Mn_{1.8}Mo_{0.1}O₄) 167162-99-4, Lithium manganese tungsten oxide
 (Li_{0.97}Mn_{1.8}W_{0.3}O₄) 167163-00-0, Germanium lithium manganese oxide
 (Ge_{0.03}Li_{0.9}Mn_{1.95}O₄) 167163-01-1, Germanium lithium manganese oxide
 (Ge_{0.45}Li_{0.9}Mn_{1.5}O₄) 167163-02-2, Lithium manganese titanium
 oxide (Li_{0.9}Mn_{1.95}Ti_{0.03}O₄) 167163-03-3, Lithium manganese
 titanium oxide (Li_{0.9}Mn_{1.5}Ti_{0.45}O₄) 167163-04-4, Cobalt lithium
 manganese oxide (CoLi₂Mn₄O₁₁) 167163-05-5, Chromium lithium manganese
 oxide (Cr_{0.2}Li_{0.9}Mn_{1.7}O₄) 167163-06-6, Chromium lithium manganese oxide
 (Cr_{0.5}Li₂Mn_{4.5}O₁₁) 167163-07-7, Germanium lithium manganese oxide
 (Ge_{0.5}Li₂Mn_{4.5}O₁₁) 167163-08-8, Iron lithium manganese oxide
 (Fe_{0.2}Li_{1.05}Mn_{1.8}O₄)

RL: DEV (Device component use); USES (Uses)

(pos. **electrode** active mass; nonaq. electrolyte secondary
 battery having lithium manganese oxide as a pos. **electrode**
 active mass)

IT 167163-02-2, Lithium manganese titanium oxide
 (Li_{0.9}Mn_{1.95}Ti_{0.03}O₄) 167163-03-3, Lithium manganese titanium
 oxide (Li_{0.9}Mn_{1.5}Ti_{0.45}O₄)

RL: DEV (Device component use); USES (Uses)

(pos. **electrode** active mass; nonaq. electrolyte secondary
 battery having lithium manganese oxide as a pos. **electrode**
 active mass)

RN 167163-02-2 HCA

CN Lithium manganese titanium oxide (Li_{0.9}Mn_{1.95}Ti_{0.03}O₄) (9CI) (CA INDEX
 NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.03	7440-32-6
Mn	1.95	7439-96-5
Li	0.9	7439-93-2

RN 167163-03-3 HCA

CN Lithium manganese titanium oxide (Li_{0.9}Mn_{1.5}Ti_{0.45}O₄) (9CI) (CA INDEX
 NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.45	7440-32-6
Mn	1.5	7439-96-5
Li	0.9	7439-93-2

L53 ANSWER 15 OF 15 HCA COPYRIGHT 2004 ACS on STN

120:119208 Lithium intercalation in oxides: emf. related to structure and
 chemistry. West, K.; Zachau-Christiansen, B.; Jacobsen, T.; Skaarup, S.
 (Dep. Phys. Chem., Tech. Univ. Denmark, Lyngby, DK-2800, Den.). Materials

Research Society Symposium Proceedings, 293(Solid State Ionics III), 39-47 (English) 1993. CODEN: MRSPDH. ISSN: 0272-9172.

AB Exptl. results for a number of oxide host materials as **electrodes** in lithium batteries are compared to obtain a better understanding of the factors influencing the electromotive force-composition relations. These factors are divided into 2 main groups: those that are consequences of the structure of the host lattice, and those who follow from the chemical of the host material. Series of materials with the same structure, but different chemical composition (**spinel**s and MO₂(B)) are compared, as well as series of materials with the same chemical composition, Li_xV₂O₅, but different structure. The potential level is mainly determined by the host chemical, although destabilization of the host can also give a significant contribution. The host structure will determine the width of the composition interval as well as the inflections of the electromotive force-curve. The possibility for tailoring the electromotive force by using mixts. of transition metals in the host lattice is discussed.

CC 72-2 (Electrochemistry)
Section cross-reference(s): 52, 78

ST lithium electrochem intercalation oxide emf structure; emf structure chem lithium electrointercalation oxide; **cathode** oxide lithium battery

IT **Cathodes**
(battery, oxides, for lithium)

IT 123550-86-7, Lithium manganese oxide (Li_{0.5}-lMnO₂) **153023-38-2**, Lithium manganese titanium oxide (Li₁-2Mn_{1.5}Ti_{0.5}O₄)
RL: PRP (Properties)
(elec. potential of lithium battery with, intercalation in relation to)

IT **153023-38-2**, Lithium manganese titanium oxide (Li₁-2Mn_{1.5}Ti_{0.5}O₄)
RL: PRP (Properties)
(elec. potential of lithium battery with, intercalation in relation to)

RN 153023-38-2 HCA

CN Lithium manganese titanium oxide (Li₁-2Mn_{1.5}Ti_{0.5}O₄) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Ti	0.5	7440-32-6
Mn	1.5	7439-96-5
Li	1 - 2	7439-93-2

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